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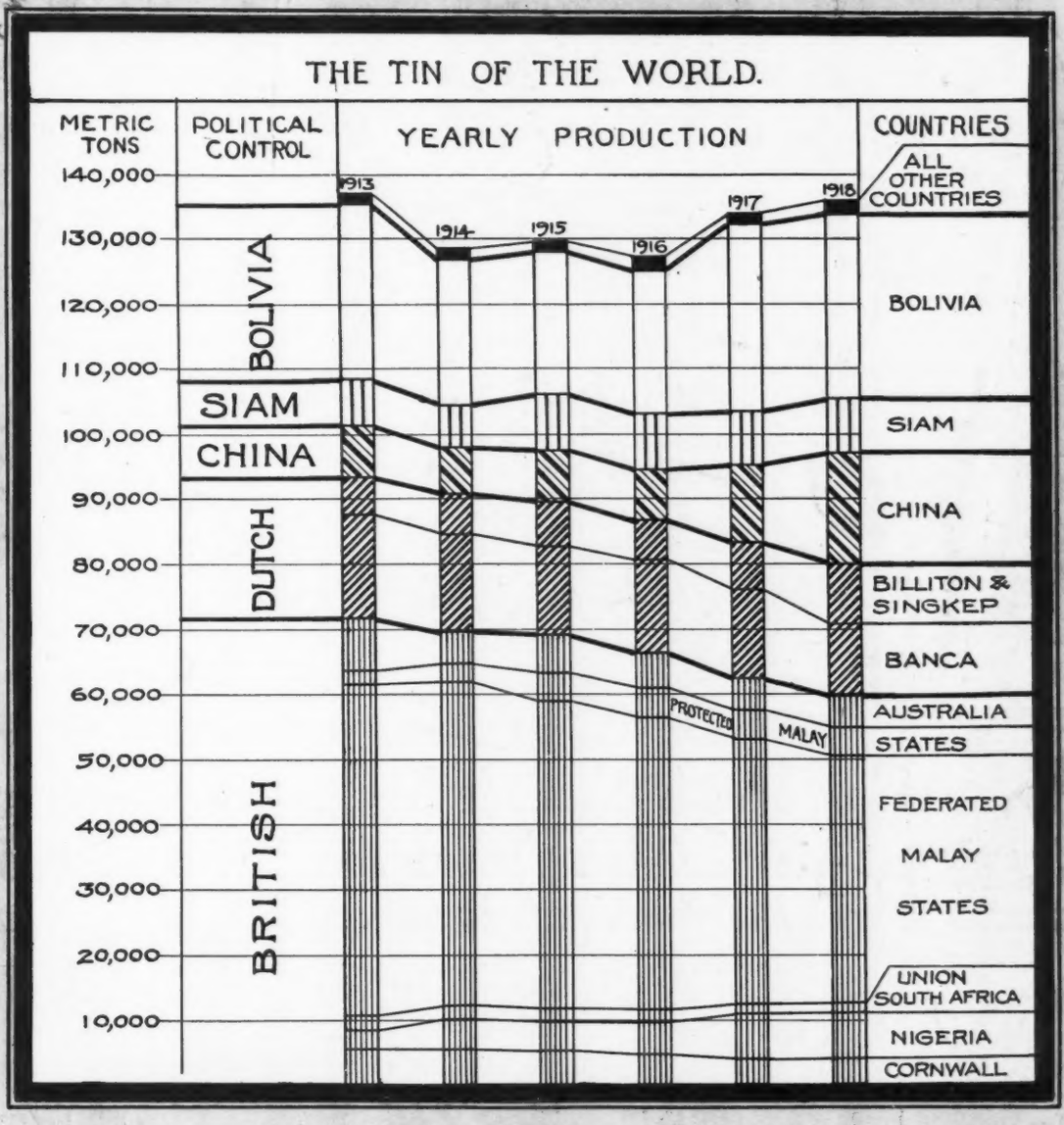
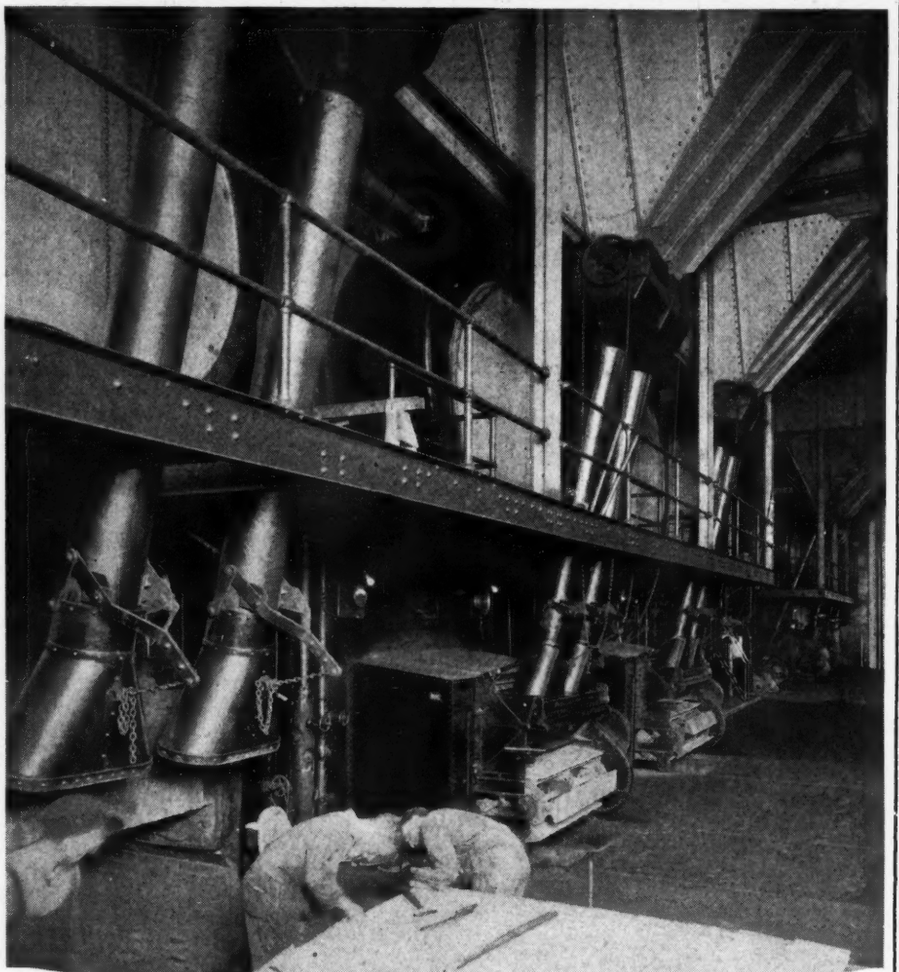


The Political and Commercial Control of Tin

by James M. Hill

The Rand Mining Industry

Biographical Sketch of Otto Mears, Pathfinder of the San Juan

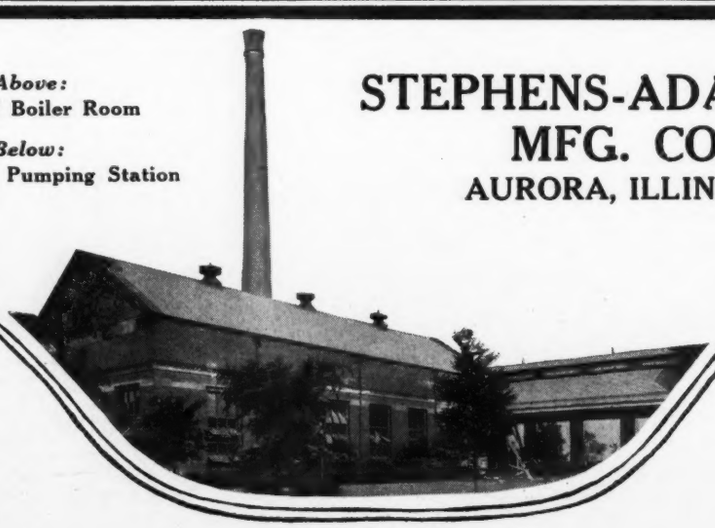


S-A Coal and Ash Handling Machinery at the Lake View Pumping Station

Above:
View of Boiler Room

Below:
Exterior of Pumping Station

STEPHENS-ADAMSON MFG. CO.
AURORA, ILLINOIS



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A Department of Public Works

ACCORDING to our Washington correspondent, the new Secretary of the Interior believes that the American people have the delusion of looking on legislation as a panacea for all ills, and that if they acted on their own initiative they could in many cases help themselves. The Secretary had in mind the agitation for Government backing of American petroleum enterprise in foreign countries; but the remark comes to our mind in connection with the agitation for a Department of Public Works. To an engineer, the title of the proposed department is good—it suggests engineering, efficiency, economy, even patriotism. Therefore, many will be in favor of it; many will say, "It is a good thing—push it along."

And yet—and yet—we cannot warm up to it. We cannot visualize the actual improved efficiency and economy as we should like to. It is understood that the head of the proposed department will be an engineer, or one with knowledge of and sympathy with engineering work and ideals. It is further proposed to avoid unnecessary upheavals; to make over the Interior Department into the new Public Works Department by eliminating the non-engineering bureaus, and absorbing the engineering bureaus from other departments. Let us suppose this were done, that the Bureau of Public Roads of the Agricultural Department, the Coast and Geodetic Survey, and other engineering bureaus were concentrated in the Interior Department. Would we have an engineer as Secretary? Would we have co-ordination between the different bureaus?

In the Interior Department we have long had the Geological Survey, the Bureau of Mines, the Land Office, and the Reclamation Service. They are the most important bureaus of the Department and all have an engineering side. Why not (1) have an engineer as Secretary; (2) have close co-ordination between the bureaus, and so obtain (a) efficiency (b) economy? No legislation is necessary.

The highly respected former Secretary, Franklin K. Lane, was a lawyer and a politician of long standing. When he resigned, we inquired here and there whether an engineer might not be selected as his successor. We were looked upon as visionary; and, sure enough, the new incumbent is true to tradition in being a lawyer. It is pretty well settled that according to our system of government the Secretary of the Navy must come from the interior; that the Secretary of War must be a pacifist; that the Secretary of the Treasury must have failed in business, and that the Secretary who presides over the engineering bureaus of the Interior Department shall be devoid of engineering. This system gives an unprejudicial point of view. It is further settled that all these secretaries should be lawyers if there are enough to go around. According to this system, the Attorney General should be an engineer; but every system has to break down somewhere.

As to close co-ordination between the bureaus of one department, the two bureaus with which our readers are chiefly interested, the Geological Survey and the Bureau of Mines, which together cover the mining industry, have not been co-ordinated in the least by the presiding Secretary. One Assistant Secretary has charge of the Bureau of Mines under the Secretary and another of the Geological Survey, so that they shall not get mixed up together; and whatever co-ordination and avoidance of duplication there have been has resulted through the good relations and voluntary friendly conferences of the two directors.

What we need, in fact, is not new legislation, which, as the new Secretary observes, will not cure everything: it will not cure lethargy and inefficiency in Washington, if and where it exists. Washington is an immense business, without any boss. It needs a Business Manager, who should serve under the President as his representative. The department heads have no great incentive to being efficient and to developing initiative—too often the opposite is the case, as Secretary Lane observed in resigning, after several years of testing this truth in practice. Washington suffers under absentee landlordism, in that the minds of many of its executives are absent on politics and on their own affairs when they might be reorganizing and administering in the interests of true efficiency—if they dared.

Under an act passed during the War, the President had the power to rearrange bureaus in the Government, precisely as is possible under the legislation proposed for the Department of Public Works; but the only use he made of it was to transfer the Chemical Warfare Service from the Bureau of Mines to the Army, and make colonels and captains out of the Bureau of Mines chemists.

You cannot legislate life into a mummy. A republican form of government does not mean necessarily popular government; and a Department of Public Works without initiative and political independence would not emulate the economic achievements of our private enterprises.

The Foolish Virgin

TURNING from the turbulent political conditions in the former Turkish Empire, and the wild clashings of races, religions, and commercial warfare, it is little short of amusing to note the debate which took place the other day in the French Chamber. Former Premier Briand asked the government to explain how England happened to control the Mosul petroleum district, within the new so-called Republic of Khurdestan, considering that in 1916 a private agreement between England and France had promised it to the latter. "Briand was Premier then," said the dispatch, "and ought to know what he was talking about." Briand is nothing if not frank. He said:

"The reason we wanted Mosul was because there is oil there, and the nation which has plenty of oil is better off than the nation that has not."

Resuming, "in diplomatic tone," Briand observed that he had "always recognized the bigness of soul of England, and thought if France asked her in the right way she would let go of the Mosul oil wells for her ally's benefit."

There is a line in the "Iliad" (or it may be some other classic) where the gods seated on Olympus broke forth in simultaneous mirth: "At that, Titanic laughter broke from all the gods."

From their seats on Olympus, which overlooks the Ægean, the old gods of Asia Minor and the inland seas look down on the Turk and the Armenian, the British Tommy, the American missionary, the French diplomat, the Arab, and the Kurd; the advance guard of merchants, mining promoters, and oil freebooters. When they listened to Briand's plaint and his afterthought of speaking softly, what monstrous rumblings of mirth must have rolled past Constantinople, and been marked with alarm by the polyglot population as the possible thunder of Bolshevik guns!

The Spring Crop Of Mining Reports

HARDLY a day has passed in the last two or three weeks that we have not been greeted by an annual report of some of the mining companies for the year ended Dec. 31. The story is much the same in every case—prosperity for the silver companies and deficits for the copper companies, with the gold producers, as a rule, occupying a middle ground, varying with the amount of silver associated with the gold. The lead and zinc companies did a generally satisfactory business.

Silver is now slipping a little from its high, and the coming year may see the profits of producers of that metal curtailed somewhat, although anything over a dollar an ounce should be highly satisfactory, even with the present excessive costs. With copper, the situation is just the reverse. The price is now equal to the average for last year, and the tendency is upward. Unless we are mistaken, the present year will see that metal selling much higher. The present demand, if we except the last three weeks, is in excess of production, and as soon as export trade begins in earnest the price will climb. Production is now and has been for some time only little better than half of the pre-war normal, and yet the copper mines and mills have been operating much nearer to capacity than the public realizes: not the machine capacity, but the labor capacity, for it is a shortage of miners and experienced operators which most companies are going to feel acutely when called upon for increased tonnage. The expected increased profits of 1920 over 1919 will be made from high prices rather than from large production. Fortunately, most of the companies have development work well advanced, so that, if necessary, some men can be transferred from this branch of the industry.

Careful inspection of the 1919 reports of the copper companies indicates that they did very well, all things considered. What we read of as a deficit is only such, in most cases, after a substantial dividend has been declared.

The copper on hand (and many companies had a great deal at the end of the year) was carried at a considerably lower figure than it would bring if marketed today. With numerous strikes, a production cut below the limit for economical operation, and many other discouraging factors, the companies really are to be congratulated on their showing.

A Great Mining School

THE greatness of a school is no longer measured by the number of its students. In the undergraduate days of some of us mature citizens there was a tendency to regard attendance as significant, but in these times of crowding and congestion there has been a distinct reversion to respect for the peculiar advantages of small schools and colleges, and a disposition to judge according to quality rather than by quantity.

The Michigan College of Mines, at Houghton, has long enjoyed a deservedly high reputation among the mining schools of the country. A combination of fortunate surroundings and wise administration has achieved and sustained this result, for money has never been lavished on it. It is situated in the heart of the oldest large copper-producing district in America—a district which is still one of the largest producers in the world; it is centrally located as regards the greatest iron-mining industry in the world; and other important mining districts, like the silver mines of Cobalt, the gold of Porcupine, and the nickel of Sudbury, are close enough geographically and geologically to be familiar. These are great natural advantages over a school located in a large city and remote from the real atmosphere of mining, and are the advantages which made Freiberg, in Saxony, the most famous mining school of Europe in the last generation. Nevertheless, Houghton is close enough to great cities to feel the pulse of the East and all the quickening and restless life that surges there. All of this would have been without avail had the conduct of the school remained a political football, as has been the experience of some of our Western mining schools: but such has not been the case. The school is administered, to be sure, by a Board of Control, selected by the Governor, but the appointees are prominent and practical mining engineers, whose office is of long tenure. This stability is reflected in the faculty, the present president and many of the chief members of that body having served for many years without friction or interruption of efficiency, with the resultant building up of prestige for their school and themselves.

A great measure of the success and usefulness of the Michigan College of Mines depends on the unusual degree of co-operation between the mines of the surrounding district (together with their engineers) and the school. Some of these engineers take the time to deliver courses of lectures to the students on mining and metallurgical subjects, and even an experienced and thoroughly seasoned mine captain acts officially as underground guide and lecturer on topics of practical mining. The result is that the students naturally assume, in this atmosphere, the attitude of the engineer, and not the overgrown school-boy attitude which sits so ill on the broad shoulders of many of our college men; and when they are graduated they are far from having to be broken into the mysteries, the charms, and the drawbacks of the mining life.

Michigan may well feel proud of her famous mining

school, despite that (owing to the War) only about twenty-five students were graduated this year. With the present emergency of high living costs to meet in all walks of life, she should see to it that the standard of the school is not unduly hampered through lack of funds.

Metal-Mine Tax Schedules

FOR the purpose of furnishing the information necessary to an accurate determination of the Federal income and profits taxes on metal mines, the metal-valuation section of the Bureau of Internal Revenue, Treasury Department, has recently sent out questionnaires to metal-mine operators. Blanks of similar character have also been forwarded to the operators of coal and non-metal mines. The questionnaire, which is the result of several conferences at Washington of officials of the Bureau of Internal Revenue, representatives of mine operators, and others, consists of eight schedules, the purposes of which are to determine the valuation, depreciation, depletion, and such other facts that will necessarily influence the assessment which is to be made on each property.

Briefly, the information requested in the eight schedules is as follows: All the facts concerning the purchase price of the property; the valuation of the property as of March 1, 1913, or date of subsequent discovery; additions to capital account (not to include expenses chargeable to current operations); details of operation, production, and cost; ascertainment of proof of depletion; ascertainment of depreciation, and proof of bona fide sale and computation of profit and loss from sale of capital assets. In addition, it is desired that maps, plans, cross-sections, and longitudinal projections be furnished.

The compiling of data necessary to the preparation of such a questionnaire has entailed considerable study and work. Representing, as it does, an endeavor to reach an equitable basis upon which mines may be taxed, the effort should be greatly appreciated by operators, most of whom are already familiar with other attempts to reach a fair system of mine assessment and taxation.

The Vaporization of Flotation Oil

ANNOUNCEMENT has been made that the Scott patents for the use of volatilized oil in flotation have been taken over by the Minerals Separation company, although the Jackling companies will retain the right to their use. Though we have not copies of these patents before us, we presume that they cover the volatilization of oil and the mixing of the volatilized oil with the air used in pneumatic flotation cells, as carried out at the Ray Consolidated mill at Hayden, Ariz. Little publicity has been given to this departure, but we understand excellent results have been secured with little trouble from plugging up the porous mats, even when using cement bottoms. The bubbles, on breaking, liberate a slight smoky vapor, but do not make the atmosphere of the mill unpleasant.

The oil may be vaporized by two methods. It may be boiled, the vapor passing into the air mains leading to the flotation cells, or it may be atomized mechanically into compressed air heated to a temperature of about 200 deg. F. The first method has the disadvantage of distilling off the most volatile constituents of the oil first, and a mixture of oils cannot be used unless each is boiled separately. Even then, close regulation would probably be difficult. The other method is the one which has been employed at Hayden.

This manner of using flotation oil has been introduced only slightly, and it has been generally considered to be one of the possible ways of evading the patent monopoly. Now that the patents have been acquired by Minerals Separation, it may be that this process will be given a more thorough trial and its merits as a purely metallurgical process determined.

South African Iron And Steel Industry

IN A RECENT number of the *South African Mining and Engineering Journal* there is an interesting review of the efforts to establish an iron- and steel-making industry in the Union of South Africa. According to the article, there is now being erected at Newcastle, Natal, a blast furnace of 120 tons' capacity per day. This was designed by McClure & Son, of Pittsburgh, Pa. Apart from the fact of the design of the plant by an American firm, the facts are of significance to American manufacturers of commercial iron and steel products who are looking to foreign markets for a part of their business.

The most important industry in South Africa is the mining industry. During the War period the difficulty of obtaining iron and steel products from both England and America caused the mining companies to resort to every device to work up scrap and to re-convert it into such manufactured forms as would enable them to make good the shortage to some extent at least. The result of these activities was to further stimulate a desire, already established, to become more self-contained in the essentials of the South African industries. This is a healthy growth, and even though it results in some displacement of certain importations, there will be a wider market for others, and more particularly the more complicated and higher types of machinery essential in the mining and other industries.

The Law of Vein Dip

IN A RECENT issue we discussed an indicated law of vein dip as around 70 deg. in western North America.

In the review of a geological report on a tungsten-tin-copper-lead-silver district in Tasmania, which appeared on April 10, note was taken of the dip of the tungsten veins. Nine cases were noted as recorded: the dips given are 67, 77, 72, 70, 45-60, 77, 70 and 70. The average of these is exactly 70 deg. All these dips were in one direction—east—with the exception of the 75 and the 45-60 dips, which were west.

These tungsten-tin veins are deep-seated; whence the further suggestion that the indicated law applies to very deep as well as to shallow fissures along which veins are formed.

The author of the paper in question, A. McIntosh Reid, considers that those vein fissures, which are near the granitic intrusion of the region, resulted from the effects of the intrusion; and those in the granite, resulted from the contraction of that rock.

In that case, why an average dip of around 70 deg. and why a general uniformity of dip to the east?

WHAT OTHERS THINK

Taking the Joy Out of the Blueprint Round

I have read with considerable interest Charles H. Waters' article in the Feb. 7 issue of *Engineering and Mining Journal*, entitled "Applying the Blueprint Round," and beg to say that I agree with him fully in regard to the standardization of hose connections, and also believe there is some merit in his application of Lufkin & Co.'s Ruler No. 863 L. But in my humble opinion the rest of his scheme for bettering one of the C's (conditions) in so far as it applies to simplifying the accurate placing of cut holes, is about the most impracticable efficiency stunt that has been pulled on the long-suffering machine man since Burleigh tightened the chuck on his first "starter" in the Hoosac Tunnel.

No doubt many of us remember, not so far back in the old piston-drill days, how a certain rock-drill manufacturer advertised the ruggedness of his machine by claiming it could be "cleaned with a boulder hammer and wiped with a scoop shovel." This plainly showed that he knew something about conditions, too. He knew that a miner rarely carried a rock drill down a stope, but, rather, turned it loose at the top, without a pilot, for a cruise over uncharted boulders. He also knew that when a miner and his partner in a drift face started to "tear down" after completing a round of holes, with only fifteen minutes left to blow the holes, load, and shoot, it was very certain that the amount of courtesy extended to the poor drilling machine was nil; and when they packed it back out of the way of the shot they didn't waste any time looking for a soft spot in which to lay it, but heaved it to one side, clear of the trackway, without even bending their backs.

It is true that "times have changed" somewhat in this regard since the advent of the mounted hammer drill, but it is still a fact that, under conditions as stated above, even the mounted hammer drill is not handled with kid gloves. Such being the case, I am afraid the degree plate and Vernier on the saddle and the graduations on the cone would have tough sledding in their endeavor to retain their legibility, especially in a poorly lighted drift or heading.

In regard to the "Useful Reference Table for Drilling"—the table itself is fine, but the application of it as explained by the author sounds like a dream. In the first place, if the table is cut down to a 4-in. x 3-in. size, as shown in Fig. 1, the numerals would be so minute as to be scarcely legible excepting under close scrutiny in a strong light, and after a few weeks' service it would be necessary to administer "first aid" to one of the C's again by hanging a magnifying glass attached to a string around the drill runner's neck.

Second, the author states that this table "should be screwed onto the drill anywhere it can be easily read and referred to." This sounds easy enough, but, inasmuch as the cylinder is the only member having a plane surface, the table would, of necessity, have to be attached to it, and when we remember that the cylinders of all modern rock drills are *hardened*, it seems to me that the drilling and tapping of the holes for the screws would in itself be a sweet job.

If the table is to be used at all, it must be fastened somewhere to the drilling rig. Expecting the driller to carry it in his pocket is out of the question, as a good machine man who has a day's work cut out for him rarely wears enough clothing to flag a hand car. He is extremely fortunate if he has one pocket to carry his chewing tobacco or Copenhagen. However, he might fasten the table to a shoestring and hang it around his neck to keep the magnifying glass from getting lonesome.

In Fig. 1, the author shows three sketches entitled respectively, "Common Results," "Better," and "Best," which serve to illustrate the proper angle and point of intersection of cut holes. Judging from the author's efforts to secure extreme accuracy on the part of the "hitherto guessing" machine man, it seems fair to assume that he must have exercised considerable care in plotting the cut holes in the above-mentioned sketches.

A miner may be a bad "guesser" occasionally, but I hardly think any miner would undertake to collar a cut hole as close to the "back," and expect to drill it at any of the three angles shown, unless he also wanted to drive a "young raise" to make room for his crank handle and also to permit the insertion and removal of the longer changes of steel. J. E. O'ROURKE.

Berkeley, Cal., April 15, 1920.

Gold Excise and Premium Proposal

Under the title, "Gold Excise and Premium Proposal," in your issue of April 10, Mr. H. N. Lawrie states:

"The wholesale index price number of all commodities in 1919 was 212, as compared to 100 in 1914, which shows that had gold increased in price in conformance with all other commodities in the United States . . ."

It is my firm belief that "prices" in the United States are usually expressed in terms of our unit of exchange value, which, as you know, is 23.22 grains of fine gold. This quantity of a certain commodity has been named a "dollar," but solely for the sake of convenience; nothing else, according to our laws, is a "dollar."

It will be noted that Mr. Lawrie says "had gold increased in price in conformance with all other commodities."

Now, if gold is the commodity, thing, or substance in terms of which all other commodities are "priced," how in the name of common sense *can* gold increase in price "in conformance with all other commodities"? For, if gold does increase in "price" at the same time all other commodities increase in "price," then "prices" *must* be expressed in something other than our unit of exchange value.

Will not Mr. Lawrie tell us in your columns what is that other thing, or substance, with which all other commodities were compared in arriving at the wholesale index price of 212? E. M.

New York, April 12, 1920.

The Flotation of Oxidized Copper Ores

I have read with great interest Walter Broadbridge's letter to you, "correcting" the following statement contained in my recent article on "The Present Status of Flotation":

"The one deficiency that has been felt most and, therefore, worked on most, is the failure of the process, even in the hands of skillful experimenters, to treat oxidized copper ores."

Mr. Broadbridge states that a new method worked out by the London technical staff of Minerals Separation, Ltd., was given a successful working trial at the Bwana M'Kubwa mine, in South Africa, the results of which look very good. I am sure that everybody engaged in milling copper ores will look forward with the greatest interest to a demonstration of the new method at one of the large copper mills in America.

I think I indicated in my article that flotation of copper carbonates is relatively easy, but that the trouble comes with the silicates. For this reason, and not knowing the relative proportion between silicates and carbonates at the African mine, I may be pardoned if in the meantime I consider Mr. Broadbridge's remarks a supplement rather than a correction of my article.

Denver, Col., April 12, 1920. RUDOLPH GAHL.

Engineers in Politics

(*A letter from an Old Scout to his Son, a recent Graduate, who asked for advice on "Entering Politics."*)

Now that engineers are headed for politics, it seems timely to call your attention to a few things that they are likely to encounter in that field. Whether they will make good or not depends entirely on the individual. Human nature is the same among engineers as among any other type or class.

The first problem in entering politics is to get the nomination. Engineers may or may not be assisted by the party or the political machine. Getting the nomination is usually considered the most trying part of a campaign, irrespective of the office sought. It is absolutely essential that candidates do considerable mixing and that they boost their own game at this stage. They will find it most advantageous to know and be able to explain just what they want, and how, when, and where they want it.

No, a blueprint won't work, nor will it do to hand every voter the same blarney. But here is the ideal opportunity to study and apply every bit of your knowledge of human nature. If you have a practical working knowledge of psychology, and you apply it, your nomination will be considerably "enchanted."

If you fail to land, remember you had lots of fun, gained some experience, and made many friends. No real politician is ever defeated; he merely slacks up to overhaul his engine.

But we hear you have been nominated. Well, son, the real fun, and the work, is just begun. Now, your nomination will be supported by the party, machine, and friends. This is the period when most nominees flunk. You can't serve two masters. You can't get something for nothing. Everything has its price.

From now on, there is only one word of real interest to you. Every man and woman that you see or hear can give you a vote. If you peddled the blarney in your party to get the nomination, you will have to hand it out now to all parties fourfold. If you are observant you will soon find that there is one characteristic which will pull you through on all occasions—a sense of humor; and you must know how to use it. Many a man has smiled his way into office. Above all, don't let anything get your "goat," anytime, anyhow, anywhere.

Of course you will sit up till the wee hours for the returns, but you won't know definitely until you read the newspapers at breakfast. Your name, as the successful office-seeker, will insure the need of a new hat of larger size, and you will turn your thoughts to the time when you take the oath of office.

Most political "jobs" will require all your time.

After receiving the keys and getting acquainted with the red tape of the rules and regulations pertaining to your duties, you suddenly wake up to the fact that you are wedged in on both sides and in the middle. You have lost your independence, initiative, and individuality. In time you are aware that you possess a soft snap, with a reasonable salary, even if you did spend a considerable sum, almost equal to your salary, to win the job. You are a real politician, and to hold your job or win a higher one, you must continue to peddle the blarney. Besides, you are a member of all the political clubs in the ward, county, and state, and just manage to break even at the end of the year and term—maybe.

When you are ready to run for re-election or a higher office, the question is, Did you eat out of the party leader's hand. No? Then you will be knifed at the post.

It's a great game, son. In some respects it's like religion. He who runs may read. DAD.

Denver, Col., April 1, 1920.

How Should an Engineer Develop His Career?

A question, I suppose, that practically every engineer has asked himself at some stage or other of his career is Am I following a plan of campaign that will yield the best results? The answer will depend on what is the individual conception of a successful career. I take it that back of every mind the fundamental stimulus to effort is a desire to acquire a competence, and the yardstick used to measure success will be prettily engraved with dollar signs. This will be acknowledged even by the pure scientist just as soon as he finds that his earnings do not cover his expenditures, and in these days of inflated prices the yardstick is ever on the laboratory table, upsetting his beakers and his calculations.

Let us assume, therefore, that the average engineer will consider himself successful if he can legitimately acquire a bankroll that he can look in the face without shuddering. How is he to make this acquisition? When the engineer leaves college he has a great deal to learn, and I believe the young man as a rule realizes his limitations, despite the popular belief to the contrary. My contention is proved, I think, by the modest initial salary with which he is satisfied. His modesty, indeed, is often excessive. Our young man has secured his first position. If he is a miner, should he stay with the one company until he has worked his way up to the top? I think not. He may know the mine from the first level to the deepest, but what sort of a showing would he make if he were offered the managership of a new mine, in which the orebody was different and which had therefore to be worked on a different plan?

I have no doubt he would make good, but his lack of general experience would prove a serious hindrance.

If the young engineer is a millman, should he remain constant to the one company until from operator he has climbed to the superintendency? I think not. Would he not be at a disadvantage if he went in a similar capacity to another mill and found the machinery of a type with which he was unfamiliar? *Festina lente*, hasten slowly, is a proverb that is more useful than the modern version: everything comes to him who doesn't wait.

No, young man of between twenty and thirty, aim for experience and not for position. Invite the hard knocks when you are best able to stand them. An all-round training in the long run means more money for yourself because it saves the other fellow money. Stay in mine or mill until you are familiar with the important items; then move along to some other place where things are done differently. Do not move at random, but as far as possible go with a definite purpose in view.

If you can, try to find work under men with a wide reputation for technical or administrative ability. Do not necessarily select the phenomenally rich mine; rather, choose the mine where the grade of ore makes every penny a matter of serious consideration. A rich mine may make the manager, but it is only a manager who can make a poor mine profitable.

The success of mining depends more on men than on machinery. The first ten years are important. Keep your eyes open and learn from all who are willing to teach, and in return always give freely of your own fund of knowledge. Build a strong foundation for the superstructure that is to come with the succeeding years.

To every man at some time or other there comes *the* chance of his career. The pity is it finds so many asleep. A mining engineer once said to me: "Don't worry about the money at first; worry about your work. Your big job will come, and in one year you will save as much as in all the previous years." It would not have to be a very big job for most of us to do that!

When you have knocked around for several years the better positions will gravitate toward you because of your training. Then select wisely and stay with the job, because your training as an executive has begun. The value to yourself of your early practical experience will manifest itself. You will know how much to expect from the machinery and how much from the men. You will understand the workman's point of view, and, knowing how and why he thinks, you cannot but promote the best interests of your employers. Your criticisms will be tempered by intimate knowledge, and will therefore not be unjust.

A feeling of having suffered an injustice is, as they say in the South, the "ranklingest" thing. At all times maintain a wide interest in life. Don't let the details of your work monopolize your thoughts. A rut is a difficult thing to get out of. Be catholic in your knowledge, and the quietest mining camp will provide something to deprive it of monotony.

An "expert" along any one line is like a diamond with but one bright face. It doesn't sparkle unless that particular side is turned toward the light. The stone would fetch a better price if it would scintillate when viewed from every direction.

Take an interest in the affairs of the country. Anything that affects the country concerns you directly. In short, it pays you to develop along generous lines. Make the world yours, and the sky is the limit.

Thomson, Ga., April 18, 1920. PAUL T. BRUHL.

Determining Copper in Slag

The method of determining copper in slag described by A. M. Smoot in *Engineering and Mining Journal* for March 20 has the merit of being very accurate and of wide application. In modified form I have used it for some years, and have found it exceedingly satisfactory. Recently, I have had occasion to determine copper in blast-furnace, reverberatory-furnace and converter slags from most of the important smelters of the United States and Canada, and this method has proved equally satisfactory in all cases.

The following practical points may be of interest:

1. Many chilled slags decompose well without the addition of hydrofluoric acid. To 5.0 gm. of slag in a 600 c.c. beaker, add 150 c.c. of boiling water, and, while stirring well, 40 c.c. of boiling hydrochloric acid. Continue to stir for a minute or two, when decomposition will be complete. Dilute at once to 400 to 500 c.c., when practically all of the silica will remain in solution. If decomposition with hydrochloric acid is incomplete, which will always be the case with air-cooled slags, add before diluting as much hydrofluoric acid as may be necessary to dissolve the silicates, boiling until clear or only a residue of coke and copper sulphide remains in the beaker.

2. Thorough washing of the precipitated copper sulphide is not necessary. Suction may be used to advantage in filtering.

3. After filtration, suck the paper dry, remove and wrap in a large qualitative filter paper, set in a crucible, and burn off the paper and oxidize the sulphide at a low red heat. This may be greatly hastened by directing a gentle current of air into the crucible, but care must then be taken that nothing is blown out. Remove, cool, brush out the ash and inclosed copper oxide into a beaker or flask. The ash of the second filter paper prevents the copper oxide from coming into contact with the crucible, and it is not then necessary to treat the latter with acid.

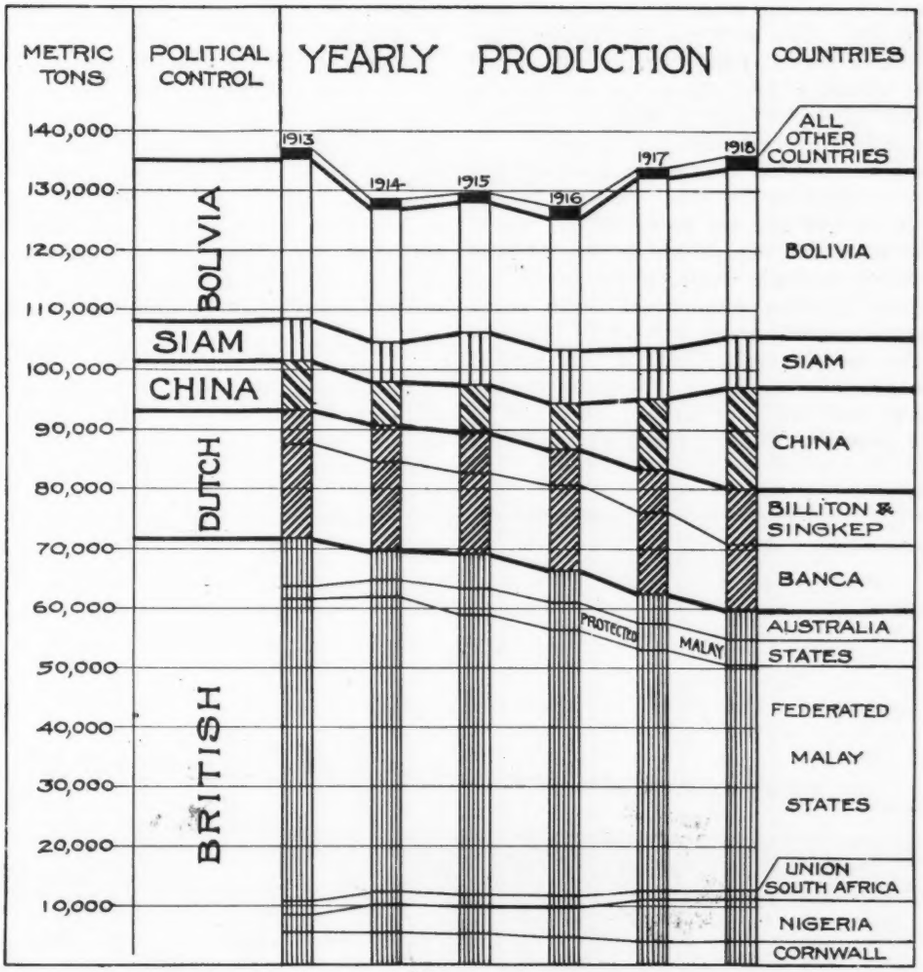
4. Instead of dissolving in nitric acid, use 5 c.c. sulphuric (1:1) and 1 c.c. hydrochloric, solution being thereby greatly hastened. The use of hydrochloric will also result in the elimination of practically all of the arsenic or antimony left after the ignition, in the subsequent evaporation to sulphuric fumes. This operation can be completed in less than five minutes by heating over a free flame. Nitric acid is of course to be added before electrolysis.

5. Copper may be deposited in a few minutes by using a heavy current with a gauze electrode, or with a rotating anode.

With the above modifications, a determination may be completed in about an hour or an hour and a quarter, and without lessening the accuracy of the method. Owing to the amount of manipulation required, however, the method is not likely to be used in routine work. A direct electrolysis in sulphuric-acid solution without filtration of the silica, and followed by a redeposition in nitric-acid solution, is much simpler and almost equally accurate when elements which would interfere with this procedure are not present.

FRANK E. LATHE.

Nickelton, Ont., April 8, 1920.



Tin—Its Political and Commercial Control*

World Production Was 130,670 Metric Tons in 1918—British Directly Command 57 per Cent—Smelting Capacity 88,300 Tons in British, 16,000 in Dutch, 12,000 in Chinese, And 18,000 in United States Control

BY JAMES M. HILL

TIN, ordinarily considered one of the minor metals, is, nevertheless, a metal of prime importance in the world's present state of development. In 1913, the value of the world's output of tin was $131,000,000, which was greater than that of either lead or zinc.

Without tin, it is doubtful if the present methods of food packing and distribution could be accomplished. The principal use of tin is in the manufacture of tin plate, from which are fabricated the so-called "tias" or "tin cans" known to everyone.

The second largest consumption of tin is for the alloys, solder and babbitt made with lead, and brass and bronzes made with copper. Minor amounts of tin are used for making fine metal tubing, tin foil, and collapsible tubes for packing such materials as dental and toilet creams, artists' colors, and like substances. Tin is also consumed by the makers of silk, principally to give weight and "rustle" to their product.

U. S. CONSUMPTION 93,000 TONS IN 1917

In 1917, the consumption of tin in the United States was approximately 93,000 tons, of which 19,000 tons was recovered from scrap materials. Of the total consumption, 31,000 short tons was used for making tin plate, 20,400 short tons for solder, 13,800 short tons for bearing metals (babbitt bronzes, and other materials), and 27,700 short tons for many minor uses, items of which are, 1,000 tons for the silk industry, 5,000 tons for foil, 4,000 tons for collapsible tubes, and 3,000 tons for white metal.

Over 70 per cent of the tin produced in the world is won from placer deposits, though in the last few years

*Published with the permission of the Director, U. S. Geological Survey. Mr. Hill has drawn freely in the preparation of this article from a mass of material in the files and publications of the U. S. Bureau of Mines and the U. S. Geological Survey. Much information on the world tin situation will be found in a report entitled "Tin Ores," by G. M. Davies, recently issued by the Imperial Institute of London. All tonnage figures used in this review have been calculated to the metric ton of 2,204 avoirdupois pounds, and have been given in round numbers purposely, as the errors of statistics and conversion do not warrant closer figuring.

Mr. Hill desires to express his thanks to Adolph Knopf, of the U. S. Geological Survey, and R. R. Horner, of the U. S. Bureau of Mines, for their assistance in the preparation of this paper, which will be one of the chapters of a book entitled "Political and Commercial Geology and the World's Mineral Resources," now in course of publication by the McGraw-Hill Book Co., Inc.

the exploitation of tin-bearing lodes has become of considerable importance. Tin ores are intimately connected with siliceous igneous rocks. Practically all of the known lode deposits are either in, or in the immediate vicinity of, rocks such as granite, granite-porphyry, quartz-porphyry or monzonitic types.

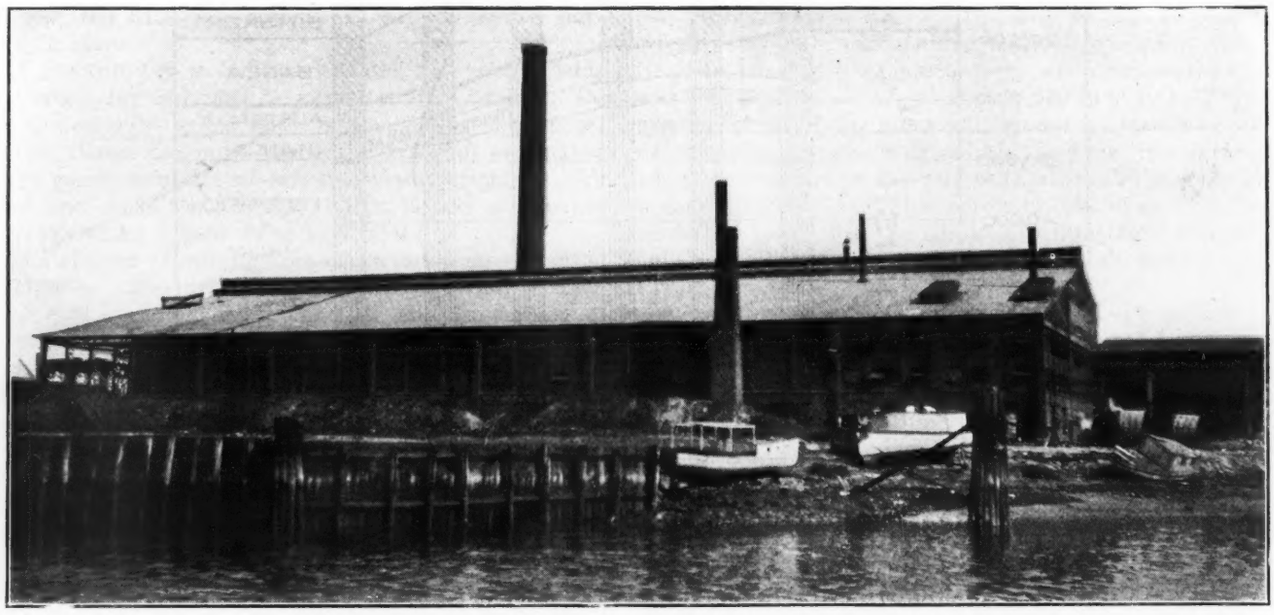
In Mexico and the United States unimportant tin deposits have been found in rhyolite. In only one or two places in the world are tin lodes known where siliceous igneous rocks are not shown on the surface, and in these places geologic evidence points to the occurrence of granitic rocks at no great depth below the surface. In the world's chief centers of tin production—the Malay Peninsula, Bolivia, Australia, Nigeria, Cornwall, and South Africa—the granite rocks are everywhere in evidence, and the tin lodes are so closely related to these granites that there is no question of their origin.

deposit is found at places in the Transvaal and Tasmania.

Generally the tin deposits are close to the contact of intrusive and intruded rocks and are more often found near the top of the intruding mass. It therefore follows that in deeply eroded granite masses the chance of finding lode tin deposits is smaller than in places where only the tops of granitic intrusions are found. It has also been noted that where the deposits are found in the intruded rocks they are generally located where the dip of the intrusive contact is low and are rarely present along a steeply dipping intrusive contact.

Cassiterite Sole Commercial Ore Mineral of Tin

Practically the only commercial ore mineral of tin is cassiterite (tin oxide), which carries 78.6 per cent of the metal. Cassiterite is known commercially by various names, such as tinstone, black-oxide of tin,



TIN SMELTER OF WILLIAMS-HARVEY CORPORATION, MILL BASIN, ON SHORE OF JAMAICA BAY, NEW YORK CITY

Fluorine-bearing minerals, such as fluorite and topaz, tourmaline, and the tungsten mineral, wolframite, are found in practically all tin deposits. Molybdenite and bismuth minerals are present in many tin deposits, though their distribution is not so general as that of the former minerals. Copper, lead, zinc, and iron sulphides, the latter often arsenical, are commonly found in tin lodes, and quartz and feldspar are the chief gangue minerals.

Form of Occurrence

It is generally accepted that the tin lodes were formed near the close of intrusive activity, by the final differentiates of the acid magmas. These final solutions are notable for pneumatolitic action and capable of causing profound alteration of granite to greisen and formation of stanniferous pegmatite and quartz veins. Greisen, an alteration product of granite, consists of quartz, mica, and varying amounts of topaz and tourmaline. It is commonly developed along fractures, and in favorable places large rock masses may be greisenized. Tin deposits are most often found as lodes, both fissure and pegmatitic, and stockworks; and some segregations are known. A peculiar pipe-like form of

black tin, or stream tin, when it occurs in placers. Tin concentrates from placer mining normally carry from 60 to 75 per cent metallic tin, 70 per cent tin being a fair average. The concentrates produced by the mills treating Bolivian lode tin make a product called barilla, which averages about 62 per cent tin. Concentrates produced from lodes in Cornwall average about 65 per cent and the lodes and placers of Malaysia carry approximately 72 per cent tin.

The lodes in many parts of the world do not carry sufficient tin to be worked; though in Cornwall and in Tasmania lodes carrying about 1 per cent of tin are being mined, in general 1 to 2 per cent in content is the lower limit for commercial lode mining. In Bolivia, the tin lodes average from 5 to 8 per cent tin, and some bodies of ore carrying as much as 40 per cent have been opened. Where low-grade tin ores have been mined, the byproducts, principally arsenic and wolfram, have helped to pay expenses, and most of these mines are advantageously located with respect to transportation and supplies. In the placers of the Malay Peninsula, including Banca and Billiton, and in those of Australia, which are worked by dredges, the tin content varies from one-half pound to as high as three pounds

of cassiterite a cubic yard, but averages below a pound. Their advantageous location, together with the fact that labor is cheap, makes exploitation commercially possible.

As will be seen from the map, Fig. 1, tin deposits are found in every part of the world, though an inspection of Table I and the chart will show that the deposits within the British Empire are the most important sources of the world supply. Bolivia and the Dutch East Indies have been the chief producers of tin outside of the British Empire, though China and Siam are steadily gaining in importance as tin producers.

Geographic Distribution of Tin Deposits

Tin Deposits of the British Empire—The British Empire has tin deposits in England, Asia, Australia and Africa. The largest production is from the Asiatic deposits in the Malay Peninsula. The African deposits in Nigeria, together with those of the South African Union, yield the second largest output of the empire; the Australian deposits are third, and the Cornwall deposits, formerly the largest producers of tin in the world, now rank fourth.

Malay Peninsula—The Federated Malay States and the British Protected Malay States occupy the southern end of the Malay Peninsula. The region is entirely British controlled, and has produced for many years one-half of the world's output of tin. In the last few years the output of tin has declined at a steady rate, owing, apparently, to the exhaustion of the easily worked placer deposits, though in 1917 and 1918 an additional cause was the scarcity of labor. The largest tin-smelting center of the world is at Singapore. Here are situated the Straits Trading Co., the Eastern Smelting Co., both British owned, and a Chinese-owned smelter, having a combined capacity of 58,000 metric tons of metal a year.

A large number of the Malaysian mines are operated by Chinese, though much English and Australian capital is invested in tin-mining companies operated in the Peninsula, and the financial control of the industry is in the hands of British subjects. Political control is exercised by a prohibitive export ($285 per ton) duty on all tin ore exported for treatment except to the Straits Settlements, United Kingdom, or Australia.

As will be seen from Table I, the Federated Malay States produce much more tin than the Protected States. Practically all of the tin in the Peninsula is taken from placer deposits, some of which are still worked by hand methods, though part of the black tin is now being mined by dredges.

The backbone of the Malay Peninsula is composed of granite, which is intrusive into limestone, shale, and quartzite. Tin has been found in place in practically all of the rock formations. Owing to the intense weathering and erosion of the tin-bearing formations, great accumulations of detritus, more or less mixed with clay, all of which carry cassiterite, are found in almost all parts of the Peninsula. The original deposits are so softened by weathering that it is possible to work them by hydraulic methods.

Federated Malay States—The states of Perak, Selangor, Pahang, and Negri Sembilan, in the Federated Malay States, produce tin. The relative importance of the states is shown by their production in metric tons of tin in 1917: Perak, 25,075; Selangor, 10,595; Pahang, 3,750; Negri Sembilan, 1,055. In Negri Sembilan, quartz veins in decomposed pegmatite are worked by hydraulicking, and a mixed tin-tungsten concentrate is obtained, which is further separated by magnetic machines. The principal mines are near Titi and Seremban.

Pahang, on the eastern side of the mountains, has many widely scattered tin deposits, both lodes and placers. The principal workings at present are in the mountains near the Selangor boundary at Bentong, Tras, and Machi. Some mining is also carried on at various places along the Kuantan River and its tributaries. Transportation is a serious item in the operation of tin mines in Pahang. Kusla Lumpur is the center of the more important tin-mining operations in Selangor. Both decomposed lode stuff and gravels are being worked. Near Serendah soft greisenized granite is worked by monitors. Near Tanjong-Malim, and on the Kalumpang and Selangor rivers, in the northern part of the state, both gravels and decomposed vein materials are worked.

The Kinta district, in the State of Perak, is the most important tin-producing area in the Federated Malay States. A structural valley eroded in soft limestones between granite ridges contains most of the workings. The valley is filled with clays and boulder clays carrying tin. The present stream channels are also stanniferous. There are fifteen or more settlements in this district about which mining is carried on. Much of the mining is by open cuts and dredges, but some lode mining is done on pipes in limestones.

Next in importance to Kinta is the Larut district, northwest of the former. Placer deposits are the chief source of tin in this district. In the south of Perak, at Bruseh, stockworks in schist are worked by hydraulicking, yielding about three-fourths of a pound to the cubic yard of material worked.

Protected Malay States—Development of the tin deposits in the Protected Malay States has been hampered by transportation difficulties. Until recently, the alluvial tin was won by crude native methods. The principal production comes from the states of Johore, Kedah, Kelantan, Perlis, and Trengganu. In the State of Perlis, peculiar gravel-filled caves in limestone, near Setul, have been mined for tin. Some of these caves have been followed for four or five miles. At Bundi and Sungei Ayam, in the State of Trengganu, lode mining under European management is practiced. The lodes are apparently decomposed stockworks in granite.

Straits Settlements—An insignificant amount of tin is mined from the beach deposits south of Kuala-Linggi, on the Island of Malacca. The tin was derived from schists intruded by granite in which there are many stanniferous veinlets.

Nigeria—As will be seen from Table I, the principal production of tin in Africa is from British Nigeria. The district was worked by natives in the early days, but no important production was made until 1904, after the subjugation of the Emir of Bauchi. The production of Nigeria has grown steadily, and reached 8,500 tons of concentrates in 1917. Apparently, all of the mines are controlled by British capital, and the exports have been largely to the smelters in England.

The alluvial deposits of Nigeria are in the valleys of the Bauchi Plateau. Soda-granite and pegmatites, intrusive into older crystalline rocks, are apparently the source of the cassiterite that has been concentrated by

the present streams. Sluicing is the principal mining method employed, though some deposits are only suitable for dredging.

Union of South Africa—The principal tin output from the Union of South Africa is from the Waterberg-Zaaiplaats district, in the western Transvaal, though a little tin is mined in Swaziland and in the Cape Province. The production has varied from 2,950 tons to 3,450 tons of concentrate per year, most of which was shipped to England for smelting before the war, but since 1915 shipments have been to the Straits Settlements. A small smelter, rated at 250 tons a year, was built at Zaaiplaats in 1917, and it is expected that it will supply the tin needed in South Africa.

The Waterberg district contains several tin fields. Tin ores are found in the red granite and Waterberg felsites, sandstones, and conglomerates. In the former the ores occur in pipes, irregular bodies of altered granite, disseminated in the granite, impregnations along fissures, and in pegmatites and quartz veins. In the Waterberg series, the tin ores are found in lodes and in irregular lenses and pockets whose location is determined by fissures of bedding planes.

In the Potgietersrust district the principal mines are largely pipe deposits in red granite. These pipes vary from a few inches to 20 ft. in diameter, and some of them have been followed for 3,000 ft. They are very erratic in direction, and are variable in composition. The pipes are filled with material ranging from slightly altered granite to a greenish homogeneous material. The outer zones are tourmaline quartz rock. In the smaller pipes cassiterite is fairly evenly distributed, but in the larger pipes the tin occurs near the outer edges.

In the Nylstroom district the principal mines are located on ore deposits occurring in felsites and shales of the Lower Waterberg series. The deposits are brecciated country rock cemented by quartz, tourmaline, cassiterite, and flourite. The Warmbaths field includes mines located along the junction of the red granite and felsites. Tin is found in lodes for both types of rocks, and some alluvial tin has been mined. In the Rooiberg field, forty miles west of Warmbaths, the tin deposits are practically all found in fissures in quartzite intruded by red granite. North of Pretoria forty miles, tin occurs in the red granite. In the Cape Province near Kuils River cassiterite is found disseminated in granite and in veins at the contact of granite and slates. Most of the small amount of tin won has been obtained from gravels derived from these deposits.

Swaziland—In northwestern Swaziland alluvial deposits along the Mbabane River have been worked for a number of years, producing approximately 500 tons of concentrates per year. At Forbes Reef, fourteen miles north of Mbabane, schists and slates have been intruded by granite, and tin lodes are found near the contact of the two formations.

Other British African Possessions—Tin has been reported in placer deposits in the Winnebah district and in pegmatite dikes in the Mankofa and Mount Mankwadi districts of the Gold Coast. It has also been found in placer concentrates from streams in Nyasaland. Tin deposits apparently of little value have been found in the Enterprise district, east of Salisbury, and in the Ndanga district, east of Victoria, in Rhodesia. These deposits are stanniferous pegmatites which are found in schists near granite.

Australia—Tin is produced in the following provinces of Australia: Tasmania, Queensland, New South Wales, West Australia, Northern Territory, and Victoria, named in the order of their importance. In 1907, the output of Tasmania was about 14,000 tons of concentrates, but production since then has steadily declined to a nearly stationary level of 3,000 tons annually for the last few years, and it is believed that this can be maintained for some time. There are tin-smelting works at Launceston, in Tasmania; at Woolwich, near Sydney, New South Wales, and at Irvinebank, near Herberton, Queensland, capable of producing over 4,200 tons of metallic tin a year. Of recent years, tin concentrates are being sent to the Straits Settlements (Singapore) for smelting. The exports of metallic tin from Australian ports in 1917 were about 3,110 tons. Practically all of the mining companies are controlled by Australian and English capital; and, as the tin is smelted either locally or at Singapore, the total Australian output can be considered as under the direct political and commercial control of England.

Tasmania[1]—The total production of tin ore from Tasmanian mines from 1880 to 1918 inclusive is stated to be approximately 128,200 tons. The most important tin mine is Mount Bischoff, forty-five miles southwest of Emu Bay. This deposit was discovered in 1871, and is credited with a total production of about 75,000 tons of tin ore. The deposits, of which there are several, are soft, altered quartz porphyries intrusive into schists. Topaz and cassiterite are disseminated in the porphyries, and veins carrying tin and wolframite, together with pyrite and arsenopyrite, are found both in the porphyry and schists. The Shepard and Murphy mine, near Middlesex, is in a zone of metamorphism at the contact of granite intrusive into sandstone and quartzite. Tin, tungsten, and bismuth are produced from this ore.

Placer tin deposits on the Ringarooma River (Derby district) supply about 1,000 tons of tin concentrates a year. Near Gladstone, placers and lode deposits carrying tin and tungsten are being worked. At the Anchor mine, in the Blue Tier district, a tin-bearing granite averaging one-half of 1 per cent tin is worked, but the operations have not been profitable. The Renison Bell, Dreadnought-Boulder, and Montana mines, in the North Dundas field, are in slates cut by dikes of quartz porphyry. Zinc, lead, and iron sulphides are important in the lodes. In the Heemskirt district, Southwestern Tasmania, the tin deposits occur in granite and overlying slate and sandstone. At the Federation mine the ore is in a pipe 25 x 15 ft. in dimensions at the surface, but at a depth of 115 ft., in contracts to only 1 x 5 ft. in size.

Queensland—Tin was first produced in Queensland in 1872, and the total production, including that of 1917, is estimated to be about 144,008 tons. In the Herberton-Cooktown districts tin occurs in greisenized granite intruded into slates, schists, and quartzite. Bismuth and tungsten minerals are associated with the tin. Placer deposits are worked by hydraulic methods, and in places the tin-bearing greisen is broken down by giants.

In the Stannhills field, near Croydon, cassiterite is found in veins in granite with galena, sphalerite, and chalcopyrite. The Kangaroo Hills, 100 miles south of

[1]Tasmania, "Report Secretary for Mines for the Year Ending Dec. 31, 1918," p. 46, 1919.

Herberton, produce both lode and placer tin. In the Stanthorpe district most of the output is from placer deposits, some of which are buried under basalts.

New South Wales—Tin was first mined in New South Wales in 1872, and the total production, including the output of 1917, is estimated at 84,230 tons of tin and 34,510 tons of tin concentrates. The chief producing districts are the Vegetable Creek-Emmaville-Tingha-Inverell region, in the northeast near the Queensland border, and the Ardlethan district, forty miles west of Temora, in the south. In the Emmaville-Inverell region the erosion of stanniferous greisenized granite, intrusive into slates, has resulted in a widespread distribution of tin placers, both in the present streams and in what are believed to be Tertiary streams that are now capped by lava. Dredging is important in this field, having been developed since 1900, and it is estimated that the dredge production up to 1917 was 18,854 tons of concentrates. Lode mining, though not so important, has been carried on in this district in pipes and stockworks in granite. The typical fluorine-bearing gangue minerals are common, and tungsten, bismuth, copper, and lead minerals were found.

Tin was discovered in the Ardlethan district in 1912, in lodes in granite and schist. Molybdenum, bismuth, and tungsten are commonly associated with tin in the greisenized lodes. The Barrier district, in the western part of the province, has not been a large contributor, because of lack of water. Cassiterite is here found in dikes of coarsely crystalline granite intrusive into greisen and mica schist.

West Australia—In West Australia, the most important tin-producing districts are Greenbushes, near the southwest, and Pilbara, on the northwest, though there has been a small recovery of tin in the Murchison goldfield and in Coolgardie. In the Greenbushes district, cassiterite is found in pegmatite and quartz tourmaline veins in granite. The tin is won from stream deposits and from laterite. In the Pilbara field, the alluvial tin has been derived from pegmatite dikes which cut granite and metamorphic rocks.

Northern Territory—The production of tin in Northern Territory has amounted to about 200 tons per year, most of which is obtained from pegmatic deposits in granite in the vicinity of Burrundie.

Victoria—A few tons of tin concentrates are saved each year by the gold placer operators in the Northeastern and Gippsland divisions of Victoria.

India—The principal production of tin in India is from the Mergui and Tavoy districts in southern Lower Burma; Thaton and Amherst districts, northern Lower Burma, and the Southern Shan States. The production amounts to about 150 tons of metallic tin a year, and is sent to the Straits Settlements for smelting. In the Mergui district, cassiterite is found in the alluvial deposit near granite hills, the granite being intrusive into sedimentary rocks of uncertain age. Tin ore is also found in pegmatite and quartz veins. In the Tavoy district tin is obtained as a byproduct of wolfram mining. The deposits occur in pegmatite and quartz veins cutting granite and sedimentary rocks. In the Thaton district, the tin-bearing alluvium is said to be rich, and development is awaited with interest. Production of tin was first made in 1912 from the deposits of Bawlake State, Karenni, and the Southern Shan States, and in 1917 these deposits were the chief producers in India.

Cornwall—In the extreme southwest of England is the famous Cornwall tin region, including the Camborne and St. Austell, and Liskeard districts in Cornwall, and the Tavistock district in Devon. The mines in this region have produced about 8,000 tons of concentrates per year, but at present the production appears to be diminishing, so instead of a production of approximately 5,000 tons of metallic tin, as in 1915, the production in 1918 was about 4,000 tons.

Tin mining in Cornwall dates back to prehistoric times. In the sixteenth century the mines produced about 700 tons of tin per year. The maximum output was reached in the period 1860-1890, when about 10,000 tons was produced annually. It is estimated that the total production of tin from this district is approximately 1,750,000 tons. The mining companies operating in this region are without exception controlled by British capital. The second largest tin-smelting capacity in the world is in the Cornwall district. Williams-Harvey & Co., Penpoll, Cornish Tin Smelting Co., Copper Pass, Redruth Tin Smelting Co., and the London Smelting Co. operate smelters having a combined output of approximately 31,100 tons of tin a year.

The tin deposits of Cornwall and Devon are located about five masses of granite which are intruded into slates (killas) and greenstones. Quartz porphyry dikes are closely connected with the granite, and the tin lodes are found in both slates and granite, being particularly abundant near intrusive contacts with low dips. The principal lodes are wide zones of fissured rock that are tourmalinized, the less important fissures containing tin and gangue minerals. Copper and tungsten minerals are produced from these lodes, and arsenic is an important byproduct of smelting. The lodes in slates are as a rule richer in copper than in the granite, and in depth they contain a larger proportion of tin than nearer the surface. The mines about the Camborne granite mass produce about 85 per cent of the tin mined; those about the Lands End granite mass 12 per cent, and the mines about St. Austell, Bodmin Moor, and Dartmoor about 1 per cent each. Practically all of the tin produced in recent years has been from lodes, but placer tin was mined near St. Austell. The lodes have been worked to a depth of 3,000 ft., which appears to be about the greatest depths to which commercially profitable ore extends. There is considerable ground above this level which is still to be developed, so the district appears to have a long period of future activity.

THE DEPOSITS OUTSIDE OF THE BRITISH EMPIRE

Outside of the British Empire the principal tin deposits of the world are in Bolivia, the Dutch East Indies, China, and Siam, named in the order of their producing importance for 1918. There are small productions of tin from deposits in Japan, Spain, Portugal, and the United States, and tin deposits are known in Germany, Italy, Russia, the Belgian-Congo, and Southwest Africa.

Bolivia—Practically all of the tin ore shipped from Bolivia is mined from lodes. The industry began late in the last century. Exports are in the form of barilla (a tin concentrate carrying 60-65 per cent and averaging about 62 per cent tin). The product has been steadily increasing, and since 1913 Bolivia has been the second largest producer of tin in the world. (See Table I and the chart). The majority of the companies operating in Bolivia are controlled by Chilean or local capital, though a little English, French, Swiss, and

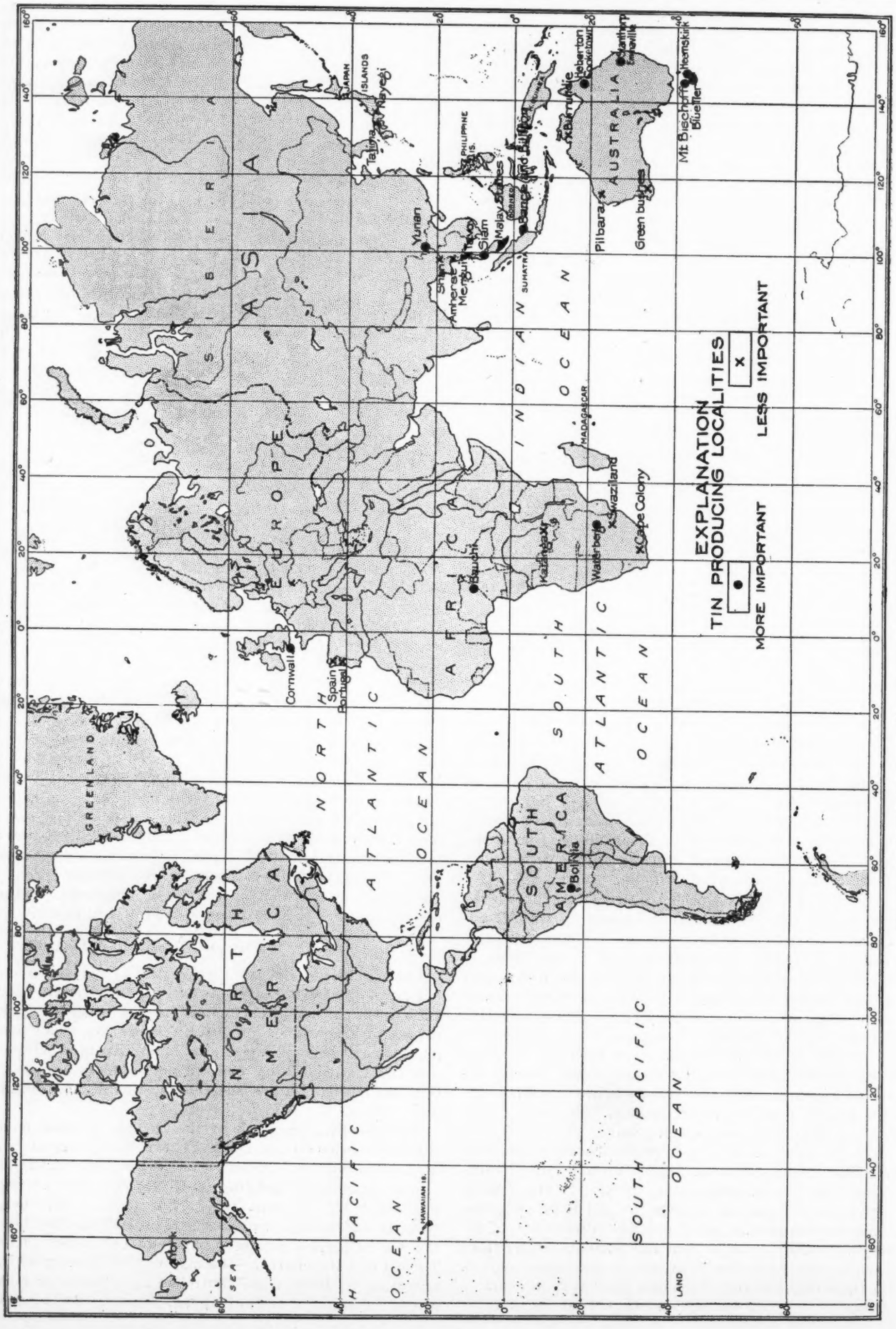


FIG. 1. LOCATION OF TIN-PRODUCING DISTRICTS OF THE WORLD

German capital was invested in Bolivian tin mines before the war. Recently, English and American capital has become interested in the Bolivian deposits. Prior to the war practically all of the barilla was sent to Germany and England to be smelted, but lately exports have been to the United States and England. A small Chilean-owned smelter with an estimated capacity of 900 tons per year has recently been built at Arica to handle the concentrates from one of the larger mines.

There are four important tin-producing districts in east central Bolivia, in the provinces of Potosi, Oruro, and La Paz. This region lies in the high (12,000 ft. elevation) plateau, and the principal mines are near or in the mountains on the east of the pampa, rather than in the western range of the Cordillera. Schists, slates, and quartzites have been intruded by acid igneous rocks, and the tin deposits are found in the granites, in quartz porphyries, and in the sedimentary rocks near the contacts. The quartz veins are strong and carry between 3 and 8 per cent tin in most of the productive mines, though some bodies of ore have been opened carrying as much as 40 per cent tin. Some of the mines were worked for silver by the Spanish, but the silver ores seem to be limited to the upper zones, the lodes becoming relatively richer in tin at depth.

Wolframite and bismuth are won as byproducts at some of the mines. Pyrite, sphalerite, chalcopyrite, and galena are usually abundant in the tin ores, and tourmaline and fluorite are of more or less frequent occurrence.

The more important mines in the different provinces follow:

Potosi	*Oruro*	*La Paz*
Uncia	Huanini	Viloca
Llallagua	Morococala	Araca
Velarde	Socavon	
Oploca	Avicaya	
Cerro Rico	Totoral	
Chocaya		
Chorolque		
Sala Sala		
Molino		

The Bolivian deposits are of considerable future importance. There are many mines and prospects which, either through lack of knowledge or finances, have not been developed. The local management of most of the mines has been notoriously poor, and it is thought that with proper technical direction a greatly increased production of tin can be made from the Bolivian mines.

Dutch East Indies—On the Islands of Banka, Billiton, and Singkep, south of the Malay Peninsula, there is an important tin-producing industry. As will be seen from Table I, the output of tin from these islands has been approximately 21,000 tons per year. Tin mining began in Banka about 1718, but the Billiton deposits were not worked until about 1860. The mines on the Island of Banka are worked by the government, but on Billiton and Singkep the deposits are leased by private concerns, mostly Dutch. The Dutch Government operates smelters, having a yearly capacity of 16,000 tons, at Banka. The concentrates produced on Billiton and Singkep are in part sent to the Straits Settlements for treatment, but some are smelted locally.

Practically all of the tin mined in the Dutch East Indies is from placer deposits, some of which are eluvial. There is, however, a little lode mining on Billiton. The cassiterite was formed in greisenized granite and sediments, and the original deposits are similar to those of the Malay Peninsula. A little tungsten and gold are obtained as byproducts of the tin mining.

China—Tin deposits in the Mengtze district, near Kochiu, Province of Yunnan, southeast China, have been worked for many years. During recent years, about 8,000 tons of tin has been exported, and it is known that considerable tin ore produced from these deposits is smelted locally, and the metal consumed in China. The exports go out through the French port of Haifong. The mining industry is entirely under Chinese control. Most of the tin ore is obtained by placer and open-cut methods from decomposed granite and pegmatitic lodes which are found near the contact of granite that is intrusive into limestone. There are less important tin deposits in the Fuchuan and Tungchwan districts, the former producing a very pure metal. The tin concentrates exported go mostly to Hongkong and the Straits Settlements for treatment, so the Chinese tin output is to some extent at the disposal of England.

Siam—In that part of Siam lying in the Malay Peninsula, tin deposits, similar in origin and occurrence to those in the British provinces, are being worked, and, as shown by Table I, are becoming larger factors in the world's output each year. The largest operations are near Renong and Tongkah, where dredging by British companies is active. The principal producing companies are the Tongkah Harbor Tin Dredging Co., the Tin Benbong, the Bangnon Valley, the Ronpibon Extended, the Beebook Dredging Co., and the Katoo Syndicate.

Japan—The tin-producing localities in Japan are near Kagoshima, Satsuma, on the south island; in Tajima Province, about fifty miles north of Kobe; and near Nayegi, Mino Province, near the center of the main island. Placer deposits near Nayegi have yielded some tin derived apparently from pegmatite dikes in granite. The Akinobe mine, in Tajima Province, was developed as a copper mine, but about 1912 tin and tungsten minerals were determined in the ore. The veins are in slates and quartzites which are intruded by diorites. It is said that in 1917 about forty tons of mixed tin-tungsten ores were produced daily. A small smelter at Ikuno handles the tin concentrates and produces around 250 tons of tin per year. The Susuijama mine, in Satsuma, produces tin from veins in shales and sandstones that also carry lead and zinc. Apparently, the output is smelted and used locally.

Spain—In the provinces of Salamanca, Zamora, Orense, Pontevedra, and Coruña (northwest Spain) there are tin deposits. Lode deposits are found near the contact of granite intrusive into schists and gneisses. Placer deposits have been worked since ancient times. In 1913 a considerable tonnage of ore was produced, but since then the production has been around 100 tons per year.

Portugal—In the provinces of Beira, Minbo, and Trasos-Montes, Portugal, just south of the Spanish border, tin lodes in granite and slates have been found and placer deposits worked in the gravels adjacent to the lodes. The yearly output of these deposits is approximately 300 tons. American capital is interested in some of the Portuguese tin and tungsten deposits.

United States—The United States has only a nominal domestic output, equivalent to from 60 to 100 tons of tin per year. The productive deposits are in the York district of Seward Peninsula. They are placers, worked by dredges, derived from lode deposits that occur near

the contact of granite intrusive into limestones in peculiar rocks of contact metamorphic origin.

Cassiterite has been mined from gravels derived from pegmatite dikes intrusive in pre-Cambrian rocks of the Black Hills near Tinton and Hill City, South Dakota, and various attempts have been made to mine the lode deposits. These deposits are of more scientific interest than commercial importance. A little stream tin has also been mined on the North Carolina-South Carolina boundary near King's Mountain. The cassiterite is an original constituent of pegmatite dikes intrusive into pre-Cambrian schists. At Irish Creek, Rockbridge County, Va., there are known stanniferous veins in coarse granites. In the Franklin Mountains, fourteen miles north of El Paso, Tex., quartz veins in granite carrying cassiterite were worked at one time, but have not recently been productive. In the Temescal Mountains, Riverside County, Cal., small quartz veins carrying cassiterite are found in acid-granitic rocks that are intrusive into metamorphosed sediments. Considerable work was done in this locality about 1880-1890, but the irregularity and low tin content of the deposits do not hold much promise for future production.

United States Dependent on Importations

Prior to the Great War, the United States, though the largest consumer of tin in the world, produced practically no tin ore, and imported only tin, having no smelters for treating tin ore. Since 1916 smelters have been erected by the American Smelting & Refining Co. and the Williams-Harvey Corporation, having an estimated capacity of 18,000 tons of tin per year. Presumably these smelters must rely largely on Bolivian concentrates.

Germany-Austria—Germany has produced practically no tin ores in recent years, though she had a smelting industry estimated at about 16,000 tons of tin per year, dependent on foreign ores. Her normal imports of tin ore before the war were 17,000 to 18,000 metric tons per year, most of which came from Bolivia. In the Erzgebirge, on the German-Austrian frontier, in the Altenberg-Zinnwald district, there was formerly some tin mining. Tin deposits are typical greisen found near the tops and sides of bodies of granite intrusive into schists and gneisses. Little or no production has been made from these deposits for several years, and they are considered exhausted.

Italy—At Campiglia Marittina, Tuscany, iron and tin have been produced from veins in limestone and shale. The output is variable and unreliable.

Russia—Tin has been found in the Trans-Baikal Province, Siberia, and in the Urals and Finland, in European Russia. The Siberian deposits are placers on the Onon River drainage. A German company was formed before the war to work lode tin deposits near Olovianoy, southwest of Nerchinsk, in the Urals. The Finnish deposits are at Pitkaranta, north of Lake Ladoga. The ores are a mixture of magnetite, cassiterite, and chalcopyrite, occurring in altered limestone and schist.

Belgian Congo (Katanga)—Alluvial tin derived from veins in granite and intruded sedimentary rocks has been found along Lualaba River and on Busanga Ridge. There are no records of production from this field, but it holds considerable promise.

Southwest Africa—Cassiterite occurs in pegmatite intrusive into granite in the Erongo Mountains east of Brandberg, and some placer tin deposits have been worked. On the whole, the region does not appear to be particularly promising.

It seems reasonably certain that Great Britain is in a position to maintain production of a large part of the world's tin for some time, the lessening output from the Malaysian provinces being offset by the increased production of her African colonies. Both Cornwall and Australia, it is believed, will be able to maintain a rather steady output around the present size for a number of years. Bolivia will doubtless be able to much increase her output of tin, and probably both Siam and China can be expected to produce larger quantities of tin in the future. Production of the Dutch East Indies can probably be maintained at about its present rate for a number of years.

Political Control of Tin Resources

England—As will be seen from Table I and the chart, Great Britain controls politically over 50 per cent of the tin output of the world, in that her political influence is absolute in England, Africa, Australia, and all of her colonial possessions on the east side of the Indian Ocean, and there can be little doubt that the strong British policy with regard to her Eastern colonies is also potent with respect to Siam and China.

Holland—The Dutch Government controls the tin output of her East Indian island colonies, in which there are smelting works apparently capable of taking care of most of the ore mined. Holland consumes little tin herself, and has at her disposal approximately 16 per cent of the world's supply. Prior to the war, Holland was a large distributor of tin, but during the war tin from her colonies was sent direct to America and England, the largest consuming countries.

China—China has a rather feeble political control of the output of the Yunnan tin mines, and as that part of her production which reaches the rest of the world is exported through French territory, largely by English middlemen, her actual control is not great.

Siam—Siam controls some important tin fields. It would seem that the strong British influence on the Malay Peninsula, coupled with the fact that the Siamese ore is smelted in the Straits Settlements, would lead to the conclusion that British policy will largely dominate the tin-mining industry of Siam.

Bolivia—Bolivia is really the only large producer of tin that can act with any considerable degree of independence. She uses little tin and produces nearly a quarter of the world's output. Her mines are controlled mostly by Chilean-Bolivian capital, and she has the world for a market. Bolivian barilla might conclusively be smelted locally, but, as Bolivia has no fuel, up to the present the tin-smelting capacity of the country amounts to almost nothing. Her nearest market at present is the United States, but it remains to be seen whether Bolivian ore will continue to be smelted in the United States, as it has been during the last few years, or be sent to England and Germany, as it was before the war. The relation of political control of tin deposits and tin smelting is shown in Table II.

Commercial Control of Tin Resources

British capital is the dominant controlling factor of approximately 57 per cent of the world's tin output, and through affiliations with capital of other countries has a partial control of about 15 per cent more of the world's

production. British capital is dominant in all of the British possessions and in Siam, and, through buying agencies, practically controls the export tin from China. As a matter of fact, Bolivian tin mines are the only ones in the world in which British control is not strongly felt. The largest part of the Bolivian output is under the financial control of Chilean financiers, with local capital the next strongest factor. French and German money has been invested to a limited extent in Bolivian mines. Recently, American capital has become interested.

Commercial Control of Tin-Smelting Industry

British—British capital controls tin smelters having a capacity of approximately 88,300 tons of tin per year. These are situated in England, in the Straits Settlements, and in Australia. The tin deposits of undoubted British control can produce ore to furnish only 62,550 tons, so that England has a smelting capacity of 15,750 tons per year in excess of her supply.

Dutch—The Dutch control the smelters of Holland's East Indian colonies, having a capacity of 16,000 tons, but their annual output of ore is equivalent to 20,200 tons of tin, so that they have an excess of 4,200 tons, which must be smelted elsewhere, and most of this goes to the smelters in the Straits Settlements, which are English owned.

Chinese—Chinese capital controls smelters that are apparently capable of handling the entire output of China, about 12,000 tons of tin per year.

American—American capital has since the war developed tin smelters in the United States and Bolivia, which have an annual capacity of 18,000 metric tons. This capacity is being enlarged and should soon be able to take care of the entire Bolivian tin output, provided American interests received the ore. But Chilean capital has built a smelter at Arica, which could handle about 10 per cent of the Bolivian output, and, if this smelter is favored by Chilean mine owners, the American smelters may find themselves short of ore.

German—German capital is interested in tin smelters in Germany having a tin-producing capacity of 15,000 tons per year. All of the ore treated must be imported, but it hardly seems possible that Germany can expect much ore from outside sources for some time, as the smelting capacity of the world exceeds the output of the mines.

The tin-smelting capacity of the world is approximately 154,000 tons, whereas the world's production of tin ore is equivalent to only about 130,700 tons. It is evident that, unless greater production is forthcoming, some smelters will be idle, and it is a reasonable surmise that it will not be either the British or Dutch smelters that lack ore. The United States, owing to its favorable situation with respect to Bolivian supply, may hope to have a large part of its smelting capacity at work, though there is some question whether sufficient ore will be available to assure the maximum operation of the tin smelters in the United States.

Position of the Tin-Consuming Countries

Great Britain—Great Britain produces more tin than she consumes, and is therefore in a position to dispose of tin to the rest of the world. A study of import and export tables shows that England consumes about 20,000 tons of tin per year and that she imports about 55,000 tons, and therefore has 35,000 tons for export. She is in a position, through her large political and commercial control of tin deposits and smelters, practically to dictate the world's tin policy.

Holland—The Dutch colonies produce about 16 per cent of the world's tin, and as Holland is normally a small consumer, she has supplied a considerable part of the tin used in Germany and the United States.

Russia—Prior to the war, a large tin-plate industry was built up in South Russia, dependent on foreign tin. The consumption was about 8,000 tons of tin per year, which was supplied largely by Great Britain, Holland, and Germany. If this industry is maintained, Russia will still be under the necessity of importing considerable tin.

Germany—German tin users, who, before the war, apparently consumed about 22,000 tons of tin, must purchase all their supplies. Before the war Germany's principal supply of tin ore was Bolivia, and of metallic tin the Dutch East Indies. It would seem reasonable that her supply of Bolivian ore may be curtailed in the future, as the United States is now in position to treat the ore, and freight rates should be in favor of shipments of Bolivian barilla to the United States rather than to Germany. Whether her tin-smelting industry will survive or not remains to be seen.

France—France has a small tin-smelting industry, treating about 1,500 tons per year. She apparently consumes about 7,000 tons of tin per year, most of which was formerly imported from British India, England, and the Dutch East Indies.

United States—The United States consumes over 80,000 tons of tin, including secondary metal, per year, and produces from domestic ores about 100 tons. Prior to the war our supplies of tin were obtained through England and Holland, as there were no tin smelters in

TABLE I. WORLD'S OUTPUT OF METALLIC TIN, 1913-1918, IN METRIC TONS. (*a*)
Metal Obtainable by Smelting From Concentrates.

Country	1913	1914	1915	1916	1917	1918
Cornwall	5,370	5,140	5,060	4,770	4,000	4,000
Nigeria	2,950	4,590	4,630	5,150	7,070	7,000
Union of South Africa	2,050	2,000	2,050	1,900	1,540	1,500
Federated Malay States	50,930	49,820	47,520	44,570	40,470	37,970
British Protected Malay States	1,800	2,700	4,170	4,450	4,500	4,500
Australia	8,160	5,520	5,680	5,550	4,970	4,900
Total British Empire	71,260	69,770	69,110	66,390	62,550	59,870
Per cent world total	52.6	54.1	53.7	52.0	47.0	45.8
Banca	15,940	14,630	13,660	14,460	13,540	11,000
Billiton and Singkep	5,300	6,090	6,760	6,780	7,300	9,200
Total Dutch	21,240	20,720	20,420	21,240	20,840	20,200
Per cent world total	15.4	16.1	15.4	16.7	16.0	15.5
China	8,390	7,120	8,000	7,630	11,800	12,000
Siam	6,660	6,740	8,520	8,960	8,600	8,600
Bolivia	26,760	22,360	21,900	21,330	28,320	28,000
Other countries	1,400	1,500	1,500	1,700	1,800	2,000
Total other control	43,210	37,720	39,920	39,620	50,520	50,600
Per cent world total	32.0	29.8	30.9	31.3	38.0	38.7
World total	135,710	128,210	129,450	127,250	133,910	130,670

(*a*) Knopf, A., "Tin in 1918," U. S. Geological Survey, "Mineral Resources of the United States in 1918."

TABLE II. POLITICAL CONTROL OF TIN DEPOSITS AND SMELTERS BASED ON ESTIMATES FOR 1918.

	Control		Control	
	Tin Deposits Annual Output, Metric Tons	Per Cent World Total	Tin Smelters, Annual Capacity, Metric Tons	Per Cent World Total
Great Britain	59,900	45.5	88,300	57.3
Holland	20,200	15.2	16,000	10.2
China	12,000	9.3	12,000	7.4
Siam	8,600	7.0	.....	....
Bolivia	28,000	21.3	2,700	1.6
Germany	.....	....	16,000	10.2
France	.....	....	1,500	0.7
America	.....	....	18,000	12.4
All others	2,000	1.7	500	0.2
Totals	130,700		154,000	

this country. During the war there was established a tin-smelting industry, which is dependent entirely on foreign ore, most of which, so far, has come from Bolivia. The estimated capacity of tin smelters in America is about 18,000 tons per year, or about 20 per cent of the estimated yearly requirement. A combination of English, Bolivian, and American capital is interested in one of these smelters, and also in Bolivian tin mines, and probably this smelter can be supplied. There is, however, considerable question whether the other smelters can obtain supplies of Bolivian ore. Certainly they will have competition from both English and German smelting concerns, which will be somewhat offset by cheaper freight to the United States than across the Atlantic. This difference is probably not large, and it would appear that if American smelters are to get Bolivian tin ore their charges must be reasonable. A surer method of meeting their ore requirements would be to obtain financial control of sufficient ore deposits in Bolivia to supply the demand.

It is apparent that the United States must in the future, as in the past, import considerable quantities of tin from both Great Britain and Holland. It is to be hoped that the tin trade routes established during the war may be maintained and that the American consumers will not have to pay the additional charges necessitated by eastern tin going to Europe and back to the United States.

Hennen Jennings

An Appreciation by Alfred James

IT WAS a warm, sunny day in spring, but glancing at the *Engineering and Mining Journal* I felt suddenly the world grow grey and cold and lonely.

The mining world has lost a man whose influence dominated its gold industry. And we who were his friends feel that somehow Virtue has gone out of the world—Virtue which for us will never be replaced. Hence the lonesomeness.

The mining industry at times produces a man, frank, self-reliant, generous to a fault and absolutely sincere, who, to his environment, becomes an inspiration. Such men I have met at Barberton; some of the Wardens in New Zealand were great examples; and there is one of the dominant engineers of Western Australia. They are not all dead—McCarthy's "Reminiscences" proves that.

Such a man was Hennen Jennings, whose dominant personality and inherent greatness imposed upon him a position in South Africa and in England unattained by any other mining engineer. At a time when feeling arose here because the highest-paid jobs in South Africa were captured by American-trained engineers, we elected Hennen Jennings our president—the only non-Britisher to achieve this honor. We went further. We presented to him our Gold Medal. Now, the Gold Medal of the Institute is one of the most jealously guarded awards. Its bestowal is no mere annual function. Years elapse without an award being made. Life work which has been epoch making is the basis. The first recipient was John Stewart MacArthur, of the cyanide process; the second was Hennen Jennings. The epoch-making life work of the latter was his conversion of South African gold mining from little more than a share-gambling speculative enterprise into a great commercial industry. Broad-minded, with a mastery of detail, generous but with firmness of purpose, enterprising but upright, he encouraged his staff by spurring them to expansions which, although beyond all precedent, were ever justified by results.

His generous estimate of human nature, his loyalty, his extraordinarily sympathetic interest, enabled him to secure and retain a staff which by sheer force of character and weight of results quieted the occasional querulous criticisms of the influx of American engineers to the Rand. His selection of H. F. Marriott, an English Royal School of Mines man, as his ultimate successor, demonstrated the pettiness of such criticism, directed against the Rand controllers generally, but never against Hennen Jennings personally.

His work in England for the Institution of Mining and Metallurgy lay mainly in the building up of the educational schemes which resulted in the establishment on a sounder basis of the Royal School of Mines and in the formation of the great Imperial College of Science and Technology of which the Royal School of Mines is now a part. His earnest sincerity, the unselfishness of his motives, the directness of his vision, the charm of his methods, won the confidence of those responsible for the official administration of education, and he was welcomed as a colleague by our most distinguished public men.

So valuable was his work that the unanimous wish of the council conferred on him the presidency for a second year—an honor only previously held by the founder and one other.

After the time had come for him to give up his English home and his work here, so that his son might be a real American by training, by home life, and by interests, it gave us pleasure to know that at Washington, too, at the round table, as administrator of the Relief Board, and in many other pre-war capacities, his desire to be of service to his fellow men and his capacity as a far-seeing administrator were appreciated and welcomed.

His memory will live; but his friends feel that somehow the world is not quite so enjoyable as it was before the sad news came that he was no longer with us.

HENNEN JENNINGS:
AVE ATQUE VALE!

The Supply and Uses of Monazite Sand

A recent bulletin of the U. S. Tariff Commission states that the gas-mantle industry, although well developed, must depend on Brazil or India for its supply of the fundamental raw material, monazite sand. This mineral occurs to some extent in the Carolinas, but the deposits are small and scattered.

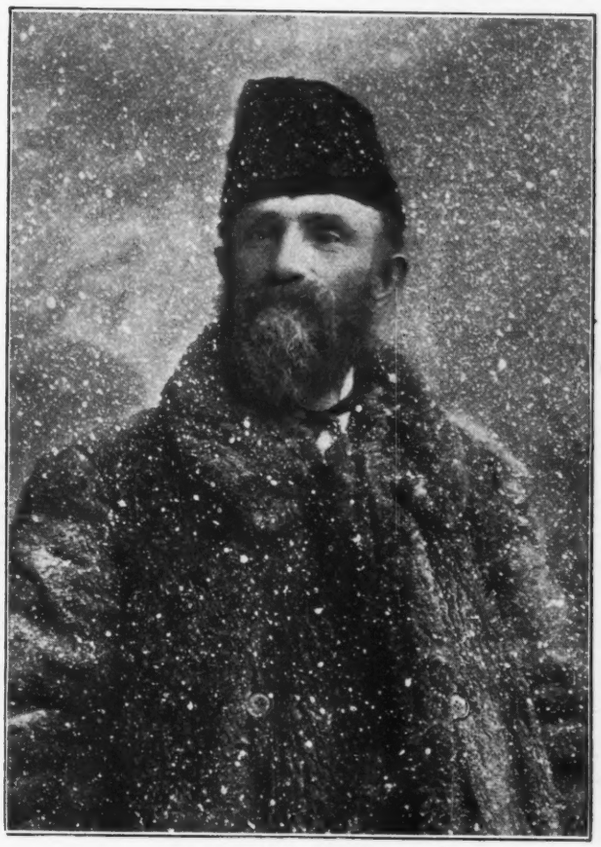
The industry presents two interesting byproducts, pyrophoric alloy and mesothorium. The former, which is a metal made by alloying iron with the surplus cerium obtained from the monazite sand, gives off a shower of sparks when scratched with a file, and this property has been utilized for the manufacture of automatic gas and cigar lighters. The other byproduct, mesothorium, is a radioactive substance which occurs in extremely small amounts—one ton of monazite sand containing only five-millionths of a pound. However, mesothorium has the same use as radium, and it is extremely valuable.

At least two manufacturers are producing mesothorium in this country, and the price quoted is about $45 to $75 a milligram, or, roughly, $2,000,000 an ounce.

Pioneers in Mining

Otto Mears, Pathfinder of the San Juan

OTTO MEARS, known throughout Colorado and the West generally as "The Pathfinder of the San Juan," has probably done more to aid the mining industry in southwestern Colorado than any other man; first in providing means of transportation and next by demonstrating that mines do pay, by operating them successfully, on no small scale. Born in Russia in 1840, Mears came to this country when only a boy, in 1851, and resided in California until the outbreak of the Civil War, when he enlisted in the First California Volunteers, in which he served until 1864, when he was honorably discharged. On leaving the Army, he went to Santa Fe, N. M., remaining there for about a year, when he moved to the San Luis valley, in Colorado, where he engaged in farming and merchandising. Realizing the necessity for roads to link this rich country with the outside world, his first effort was the building of the Poncha Pass toll road, to connect the valley with Pueblo and Denver, and from this time he spent many years in constructing a network of toll roads in southwestern Colorado.



OTTO MEARS

In 1873 Mr. Mears started a road from Saguache to a point in San Juan County about fourteen miles north of Silverton, where he founded the town of Animas Forks, adjacent to which are now situated the Sunnyside and Gold Prince mines, recently purchased by the U. S. Smelting, Refining & Mining Co. While this road was in course of construction through Hinsdale County, which it traverses, rich mineral deposits were discovered, and Mr. Mears founded the town of Lake City and started a newspaper there, *The Silver World*, to advertise the mineral resources of the district. He also did some mining on the Belle of the West and other properties.

In 1882, a rich discovery in the Yankee Girl mine at Red Mountain, Ouray County, made necessary a road from Ouray to Red Mountain, as pack animals were found inadequate for the transportation of supplies to, and ores from, the rapidly growing Red Mountain district. The Ouray toll road, as it is commonly known, though it is now a county road, from an engineering and scenic viewpoint is undoubtedly Mr. Mears' best achievement. Among the most important roads that he built, in addition to those mentioned, are those from Ouray to Sneffels, where are the great Camp Bird and other mines; from Ridgway to Telluride, and many shorter but no less important links in what was known as the Mears system. With the march of progress, wagon roads soon proved inadequate for the handling of the tonnage which the San Juan region was fast developing, and in 1885 Mr. Mears built the Silverton Ry. from Silverton to Red Mountain and Ironton, which made possible the shipment of the lower-grade ores from the Red Mountain district to the smelters at Silverton and Durango. Soon after this, he built the Rio Grande Southern R.R., 187 miles. In 1889, Mr. Mears, associated with others, built and operated the Standard smeltery, at Durango, designed to treat the copper ores from the Red Mountain and other districts. In 1895 Mr. Mears began the construction of the Silverton Northern R.R., from Silverton to Eureka, with a branch up Cunningham Gulch and which was later extended from Eureka to Animas Forks. During this long period of road and railroad building, which resulted in the development of the mineral resources of the San Juan Triangle (San Juan, San Miguel, Ouray, and Hinsdale counties) Mr. Mears was not blind to the opportunities which the mining industry presented, and at various times he operated a number of mines in the district.

For the period from 1898 to 1907 Mr. Mears was not active in Colorado, though he retained his interests there, but spent much time in the East, where he was engaged in various enterprises.

On his return to Colorado, Mr. Mears and associates leased the Iowa-Tiger group, which has operated continuously since that time. In 1912 he leased the Gold King group, at Gladstone.

Though it is to be regretted that Mr. Mears has no son to perpetuate his name, his surviving daughter (Cora Mears Pitcher) has four boys, one of whom is properly named Otto Mears Pitcher.

The Safety-First Movement

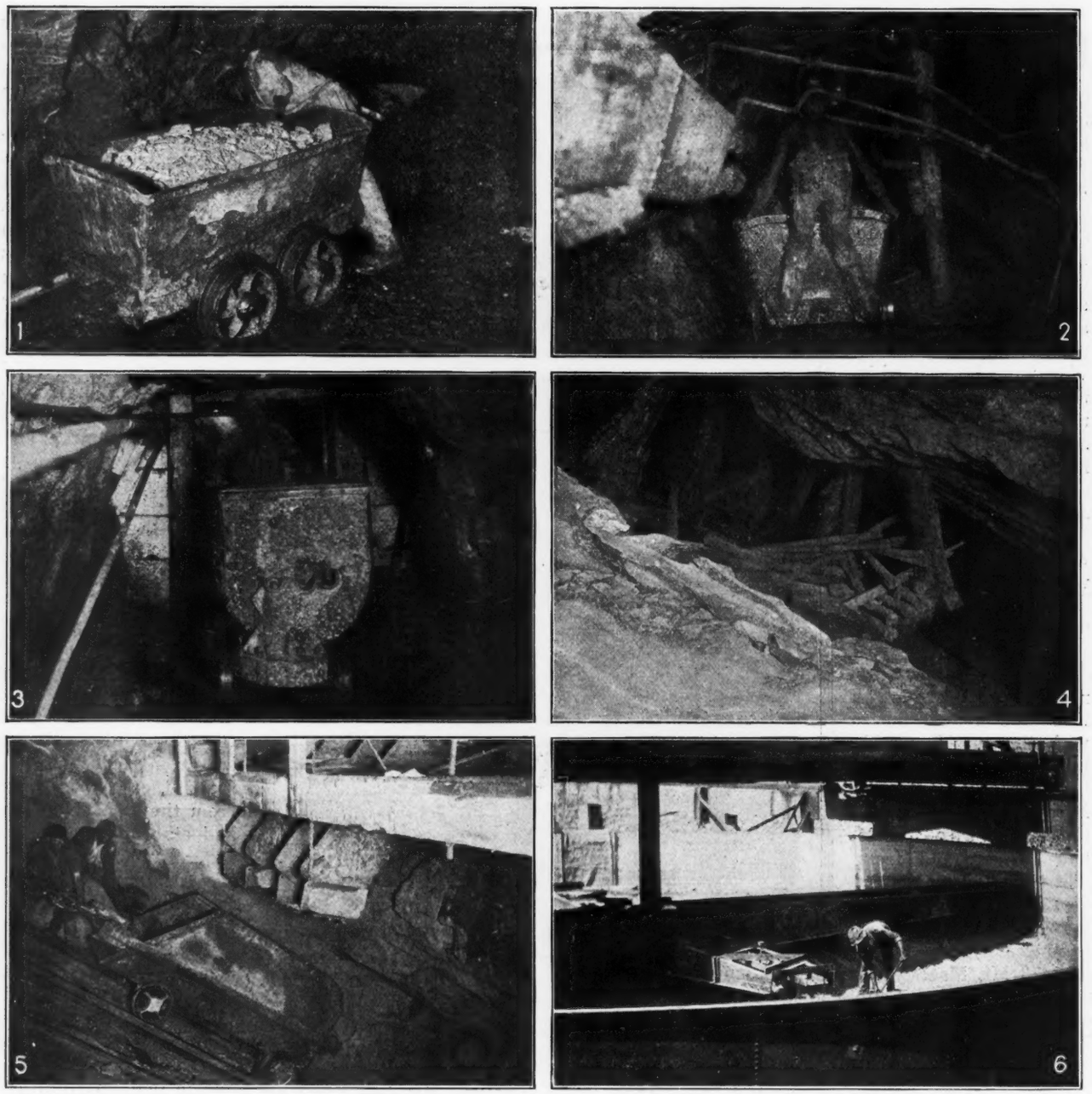
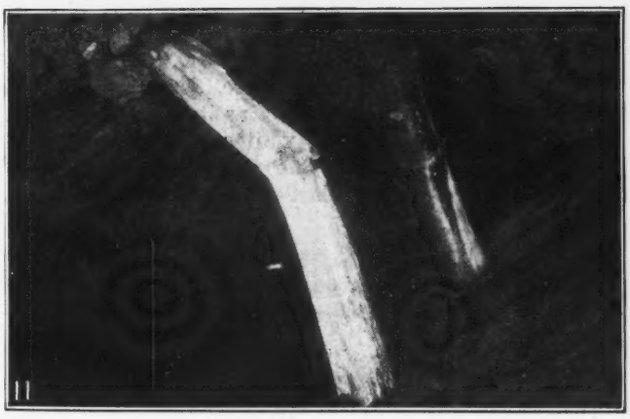


FIG. 1. CAR OFF TRACK. FOLLOWING CAR TOO CLOSE IS APT TO JAM NATIVE. FIG. 2. NATIVE RIDING ON CAR; HEAD LIABLE TO COME IN CONTACT WITH PIPES. FIG. 3. DANGER OF JUMPER (CROWBAR) STICKING IN SIDE OF DRIFT, INJURING NATIVE'S HEAD. FIG. 4. BADLY CRUSHED GROUND REQUIRING TO BE BARRICADED OFF. FIG. 5. DANGEROUS POSITION OF MEN IN SHAFT SHOULD SKIPS MOVE. FIG. 6. NATIVE WORKING IN TANK, MECHANICAL

IT IS ESTIMATED that there are about 300,000 natives, or "boys," as they are called, working the South African gold mines, supervised by about 35,000 white "miners." Naturally with such a large number of unskilled laborers, accidents may be expected to be above the average of those occurring on the mines in other parts of the world worked by skilled labor. It is only in recent years that serious attention seems to have been given to the question of safety in the mines. The Rand Mutual Assurance, Ltd., an insurance company maintained jointly by gold mine employers, has now definitely started a Safety-First campaign, and decreases in accidents are becoming noticeable.

As the natives cannot read, considerable use has been made of pictures that graphically depict accidents, and these are now to be seen on all of the mines. When the natives first arrive at a mine they are told about the various things to watch for when working.

in South African Gold Mines



EXCAVATOR IN OPERATION. IF HE SLIPPED HE WOULD BE PLOWED UNDER. FIG. 7. RUSHING CAGE. FIG. 8. BOTTOM OF VERTICAL SHAFT SHOWING CHAIN LADDERS, WATER HOSE, HARD HATS AND SINKING MACHINES. FIG. 9. WORKING IN MORTAR BOX; PUTTING HANDS UNDER STAMP IS DANGEROUS. FIG. 10. EFFECT OF TRESPASSING BEYOND BARRIER. FIG. 11. SHOWING STRAIN ON TIMBERS, AUSTRALIAN BLUE GUM. FIG. 12. SAFETY BARRIER

Practices by white men that endanger the lives of the native workers are also strongly combated.

Natives are like children in many ways, and do the most absurd things when traveling up and down in cages and working in drives and stopes. When pushing freight cars (coco-pans, as they are called in South Africa) they often become mechanical and continue to push when reaching an incline, when the car suddenly jerks out of their hands and causes havoc in some other part of the mine. It is very difficult to make the native workers use safety devices, such as steel helmets, as they will not usually weigh the feeling of discomfort against the chance of accident.

The illustrations give a good idea of working conditions in a South African gold mine, having been taken at the instance of the Rand Mutual Assurance for the safety campaign. The scenes are on the Nourse mines, which employs thousands of natives.

The Rand Mining Industry

Reduced Tonnages Due to Diminished Running Time of Milling Plants—Average Grade of Recoveries Improves—Ratio of Expenses to Total Output Increases Rapidly—Normal Profits Reduced

BY A. COOPER KEY
Written exclusively for *Engineering and Mining Journal*

IN 1914, the average working costs on the Rand were 17s. per ton. In 1919, the figure had advanced to 23s. Against this increase of 6s., there was an improvement in recovery of somewhat over 2s., from 26s. 6d. to 28s. 8d. per ton. Higher wages paid to white workers, who are the supervisors, and not the manual workers, as elsewhere, in the mines of the Rand, due to incessant demands to meet the enhanced cost of living officially assessed at between 35 and 40 per cent over normal; higher prices of stores all round, shorter hours and lessened efficiency, and, of late, increased assessments under the Miners' Phthisis Act, are the main factors in the enhanced rate of operating charges. Mealies or maize, the staple food of the native workers, who are fed and housed by the companies, is now 35s. per bag, compared with 12s. Meat is much more costly than in 1914. The general shortage in the supply of native labor has also contributed to high costs, as it is impracticable to operate the reduction equipment at anything like the designed capacities of the machines. Plants must necessarily be worked at or near full load if standing charges are to be reduced to a reasonable figure per ton of ore crushed.

TONNAGES ARE CONSIDERABLY REDUCED

The Rand companies crushed 24,043,600 tons in 1919, as compared to 25,702,000 tons in 1914. About 1,300 fewer stamps are in regular operation (7,936 as against 9,227), but the number of accessory tube mills has increased from 285 to 329. The reduction in stamps is due to the closing down of certain properties, owing to their inability to operate at a profit (due partly to increased costs arising directly and indirectly from the war conditions), to exhaustion of ore in others, to concentration of reduction equipment in a third class, and to the hanging-up of stamps here and there, consequent upon diminishing stope faces. The reduction of aggregate tonnage in 1919 was 918,000.

RUNNING TIME OF REDUCTION PLANTS DIMINISHED

A striking feature is the shorter running time of the reduction plants. In 1914, the average for the stamps was not less than 311 days. Last year it was only 281. This is a decrease of about 10 per cent. One cause is the incidence of the Sunday Law, which prohibits the operations of reduction plants, erected after a certain date, on that day. Several of the newer plants of the Far East Rand come under this stipulation, and many of the companies concerned have large equipments, influencing considerably the general average. There must have been, in addition, a good deal of poor running time, or "mill hung up for lack of rock," at the majority of the properties. The Chamber of Mines recently agreed to grant Labor Day, May 1, and Dingaan's Day, on which the Dutch celebrate the victory of their forefathers over the Zulu chief Dingaan, as full holidays in addition to Christmas Day and Good Friday, previously the only recognized holidays at the mines.

The improvement in average-grade recovery is attributable to the larger tonnage from mines of the richer Far Eastern Rand, to economic elimination of unprofitable mines, and to selective mining, which has been resorted to in order to avoid the closing down of a considerable number of properties. Cumulatively, these factors represent about half a dwt., the recovery being 6.75 dwt., as against 6.23 dwt. in 1914; one-third of the advance occurred during 1919.

But for this enhancement, the Rand would be, apart from considerations of gold premium, to which special aspect I refer later, in a precarious position, viewed from an investment standpoint. The recovery in 1914 was 26s. 6d.; the costs last year were 22s. 11d. per ton. The margin of 3s. 6d. per ton would just about meet the amounts required for amortization of plant and machinery, which has been calculated at 1s. 9d. per ton, and of the price given for the property, figured at 1s. 5d. per ton. Thus, after these two primary investment requirements were satisfied, the balance remaining for remuneration of capital in dividends would be negligible. This is, of course, a representation of the average position, for there are some highly remunerative mines.

LAST YEAR'S RATIO OF EXPENDITURES TO OUTPUT 80 PER CENT.

The growth of total expenditure, for reasons mentioned, has been remarkable, and, as it is spent in a relatively small community of whites, it has brought a good deal of prosperity. The Rand Gold production and expenditure for the last six years are given in Table I.

TABLE I. RATIO OF EXPENSES TO OUTPUT

	Output	Expenses	Ratio Per Cent
1914	£34,124,434	£21,943,692	64.2
1915	37,264,992	24,657,659	66.2
1916	38,107,909	25,763,270	67.6
1917	37,017,633	26,129,156	70.6
1918	34,823,017	26,848,547	77.1
1919	34,454,478	27,518,253	80.0

Though the output in the first and last years of the series was practically stationary, the actual increase being only £330,000, working expenditure increased regularly until it is now £5,575,000 higher than in the year which witnessed the beginning of the war. Instead of each sovereign's worth of gold costing 13s., as in 1914, it now costs 16s. A profit of 20 per cent on turnover, and even that subject to taxation, is nothing much to boast about in these profiteering days.

NORMAL PROFITS £5,000,000 BELOW 1916

From the foregoing table it is evident that the margin of profit has constantly diminished. The Rand, under normal circumstances, certainly cannot stand 24s. 6d. working costs, the average of the final months of 1919.

The high average for the year, though still below that of later months, together with reduction in tonnage, has brought the profit of the Rand mines down to £6,605,509, as against £7,500,270 in 1918, £10,225,633 in 1917, and no less than £11,630,000 in 1916. Only in the last two years has the aggregate fallen below ten millions since the Chamber of Mines has collated profit statistics. To go a little further back into history, the total is £5,600,000 less than in 1912, and £5,500,000 below the profit earned in 1908, when six million tons less was crushed. Though shareholders in Central, Western, and Near East Rand properties have had their dividends whittled down to the vanishing point in the cases of certain important mines, the local storekeepers and workers have benefited, as an ever-increasing proportion of the sovereign has been retained in the country. Five shillings per ton on 24,000,000 tons means £6,000,000, of which the major portion is spent in the Rand community. The mines actually spent £27,500,000, as against £16,250,000 in 1908. They are now crushing a third more tonnage, but making not much more than half the profit. This is excellent for labor beneficiaries, but makes little appeal, except in certain favored instances, to the investor.

Native Laborers Asking for More

The native laborer has not yet received any additional pay, but what is at present a scarcely expressed demand may, at any time, develop into insistent clamor. Imitative to a degree, the native will not be slow to take a leaf out of the white man's book. Already, the railways, municipalities, and other large employers, among them the De Beers diamond mines, have found themselves obliged to concede extra payment. The gold mines may have to follow suit. A native mine worker receives in cash 2s. per shift, an advance of 6d., and 1s. is the more general demand. Applied to 162,500 natives employed in the large mines of the Witwatersrand, this would mean £105,000 monthly, equivalent to 1s. per ton. A native has his simpler wants supplied while he is on the Rand, but finds the money he remits to the kraals for his family does not go nearly as far as it did. Moreover, his own demands are increasing, and what were erstwhile luxuries are now necessities.

The "Cramping Extravagance" of the "Color Bar"

The native worker is prevented from earning sums commensurate with his ability by the operation of the "color bar" in the Transvaal mining regulations, which reserves positions of responsibility, even of moderate skill, for the white man. This has been styled a "cramping extravagance." Mr. Taberer, general manager of the Native Recruiting Corporation, born and brought up among natives, declared that inefficiency among whites has become a byword. "This and lack of ambition detrimentally affect the results obtainable from native workers, who are chafing under a system which not only precludes their employment at the classes of work which by education and application they have become thoroughly qualified to perform, but which insists on their being set to work under the supervision of palpably unskilled Europeans, many of whom have to be taught their work by natives whom they are in charge of. Such a system is uneconomic, unjust, and immoral."

Though the profits are down to £6,605,500, a drop of £900,000 for the year, the curious anomaly presents itself that the dividends distributed are actually a million to the good, at £6,390,100, and that after taking into consideration certain dividends paid in scrip at either face value or cost of acquisition, either being considerably below market price. If one were less conservative (some people might use the word arbitrary) the dividends would actually exceed the profits. But, as there are such things as profits tax, debenture interest, and Miners' Phthisis Act contributions, this is impossible. The whole explanation lies in the fact that declared profits are not real profits, and that since July 25 the Rand has benefited from the free market in gold. The topsy-turvy condition of exchanges throughout the world has benefited the Rand by the enormous price paid for gold. At the moment the price is 117s. 6d., against the normal 85s. per oz., a premium of 32s. 6d., representing 38.5 per cent. This is double the figure assumed by certain of the Rand mining groups in estimating profits for the last five months of the year.

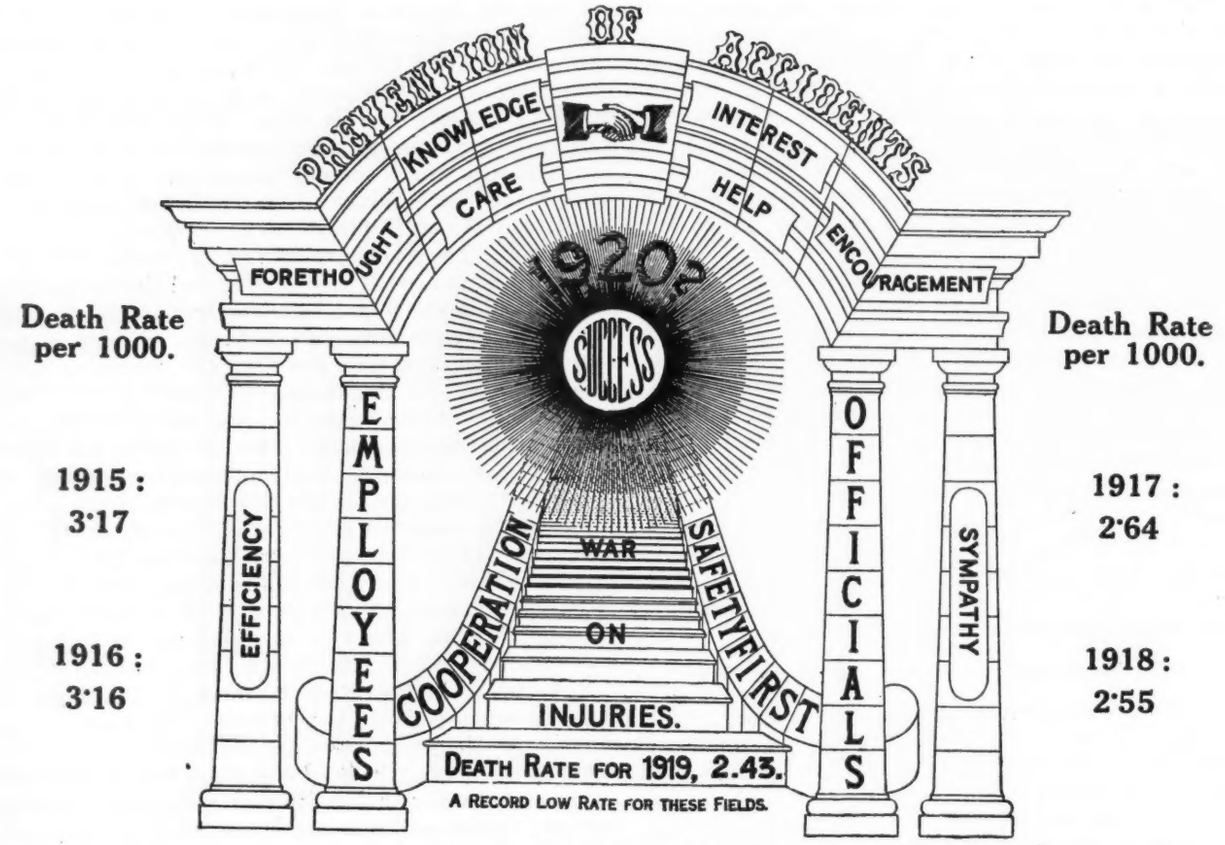
The Rand output in that period was 3,362,000 oz., valued at £14,281,150. The premium amounts to between 3,000,000 and 3,500,000 sterling, whether the premium be taken at 20 per cent, which is conservative, or at 25 per cent, which is only 106s. per oz.; whereas gold was never below 110s. in November and December, and is now as high as 114s. Practically the whole of this is extra profit. It is well within the mark to say that, with the gold premium included for the five months, the actual profit of the Rand was £10,000,000 last year. That is the reason why the margin between declared profits and announced dividends is negligible in contrast with a divergence of £2,150,000 in 1918, and as much as £3,500,000, £4,000,000 and even £4,750,000 in 1912. Allowing for the gold premium, the difference is about £3,400,000, or only £200,000 less than the average difference of the previous four years.

Neither the Mines Department nor the Chamber of Mines "sees the forest for the trees." Proverbially, it takes a long time to awaken a government department. Even the Chamber of Mines contents itself with a repetition of the saving phrase "gold in the above return is valued at the fixed rate of £4.24773 per fine ounce." An unsophisticated statistical delver, relying on these two official returns, would know nothing of the enormous gold premium, now approaching heights reminiscent of the state of things at the time of the Napoleonic Wars.

Low Accident Mortality a Record

A feature of the year has been the attainment of a record low accident mortality. The figure of 2.43 per 1,000 will compare favorably with the rate in the United States, always remembering that 90 per cent of the Rand workers are natives of varying degrees of intelligence. Eight years ago nearly 900 persons lost their lives in mine accidents. In 1915 and 1916 the number was about 700. In each of the succeeding two years fatalities were still over 500, but in 1919 the number was reduced to 472. In ten years the number of fatalities has been halved. This is a triumph for Safety-First propaganda.

The Prevention of Accidents Committee, familiarly called the "Safety-First Committee," of the Rand Mutual Assurance Co., of which the mining companies are members, has been an active factor in attaining this result. The Mines Department of the Union, headed by that capable official Sir Robert Kotze, gov-



COVER PAGE OF *THE REEF*, THE "SAFETY-FIRST" MAGAZINE OF THE RAND

ernment mining engineer, has given unremitting care to safety problems. *The Reef* magazine, bulletin boards, and lectures have enlisted the active co-operation of the men. Eight years ago the rate was as high as 4, and the attainment of 3 appeared an excellent ideal. The rate is now under 2½, and the new ideal is placed at 2. In 1919 there were 2,302 separate accidents, an increase of 300, but the deaths were 43 fewer. Special attention is now paid to minor wounds sustained by natives, in order to prevent septicaemia. Col. Orenstein, C. M. G., of Panama Canal experience and head of the Mines Health Department of the Rand Mines-Central Mining Organization, has done remarkably good work in this connection, with, if I may say so, characteristic American thoroughness.

Accidents in 1918 and 1919

The comparative statement of accidents occurring in 1918 and 1919, according to the Mines Department classification, is given in Table II.

The most important reduction in accidents is under the heading "fall of ground," 150, as against 183 deaths. In 1916, there were 250 deaths from this cause. The reduction is due largely to greater insistence upon roof examinations and sound mining principles, the closing of certain old mines, and better stowing. In explosives accidents, safety procedure has been especially fruitful. There were 60 deaths, but in 1915 and 1916 there were 160; and previous to that the average was over 200. What can be done by organization is shown by the City Deep, which has reduced its rate from 4.13 to 0.38, enabling the mine to carry off the Rand Mutual's prize with ease. Only two persons were killed in this mine, as against 25 and 16 in the two previous years. The important New Modderfontein keeps its rate below the one recorded in 1918, there being only five deaths among five thousand employees. Crown Mines has a rate of 1.76, commendably below the average. Government Areas and East Rand Proprietary mines are about the average. At another large mine, the Randfontein Central, the rate has increased from 2.73 to 4.3, or higher than five years ago. Randfontein has steep stopes, in which rolling stones always increase the number of accidents. There has been much shaft sinking in the new north and south verticals, and shaft sinking is usually dangerous, though Ivor Rees, at the Crown Mines, has shown that it need not necessarily be so.

TABLE II. MINE ACCIDENTS AND CAUSES

	1918			1919		
	Number of Accidents	Deaths	Accident Death Rate per 1000	Number of Accidents	Deaths	Accident Death Rate per 1000
Fall of ground..	459	183	0.91	535	150	0.77
Machinery.....	116	15	0.07	130	16	0.08
Trucks and tramways.....	370	56	0.28	464	47	0.24
Fall of material.	453	55	0.27	562	58	0.30
Falling in shafts, excavations, etc.	45	29	0.14	41	34	0.18
Struck by cage, traveling by cage, breakage of rope, traveling by ladder, overwinds, electricity, boilers, and steam pipes	115	105	0.52	140	83	0.43
Miscellaneous...	353	18	0.09	350	24	0.12
Explosives.....	96	54	0.27	80	60	0.31
Totals.....	2,000	515	2.55	2,302	472	2.43

Careful and Systematic Washing of the stoped-out areas in many of the South African mines, followed by sluicing, results in the recoverey of considerable gold. In spite of thorough cleaning with shovels and brushes, an appreciable amount of high-grade fines would otherwise remain in the mine.

By The Way

Beautiful Nature

The ordinary promoter might be well advised to study the literature of the Golden Summit Mining Co., a gold prospect of questionable merit in northern Ontario. The promoters of this enterprise, in their stock-selling campaign, believe in appealing to man's poetic nature, rather than to his cupidity. On April 29 the company planned to run a special car excursion to the property, and the following is taken from its circular giving the itinerary:

On Thursday evening the car will be placed on the siding at Golden Summit, the highest point in Ontario, generally known as the "Height of Land." Friday will be spent gathering gold samples from the dump at the mine, watching the myriads of fish at play at Kapakita Creek, passing over the various winding trails on the company's property, making canoe trips on the beautiful chain of lakes, and, in the evening, a grand banquet will be given on the rugged shores of Kapakita Lake, amid the fragrance of the evergreen pine, spruce, and balsam of that region.

After such a feast of nature, stock selling should be brisk.

Oh, you little fishes!
Oh, you winding trails!

In the Potash Mines

"The reproductivity of individual laborers in the German potash mines is very much diminished," said a New York daily recently. "The underground working day is now seven and one-half hours instead of nine, as formerly, and the surface working day is eight hours in place of ten."

Whimsical

A new use for a certain popular-priced automobile has been reported in the Missouri-Kansas-Oklahoma zinc and lead field. Not long ago a mining engineer went with a mining operator to inspect an abandoned shaft on an Oklahoma lease. When they arrived they discovered there was no derrick at the shaft, only the frame of an old hand-hoist. Nothing daunted, the engineer procured a 200-ft. rope, attached it to the back end of his car, tied the other end around the shoulders of his friend and by backing the car lowered him 150 ft. into the shaft, and hoisted him out again without mishap. Both argue that it is a safer and more convenient method than trusting to an old, rusty hoist.

Mica Smelter for Quebec

"The white mica mine discovered near St. Felicien, Que., by F. X. Gagnon, of Sherbrooke, an experienced mining prospector, is said to be on the way to wealthy production," says a Montreal newspaper. "Shafts have been sunk, and mica is being extracted, while the erection of sheds, smelters and other buildings is rapidly nearing completion. The mica from the mine is expected to reach the market throughout the summer."

"Cuprum" Launched

The good ship "Cuprum," of the emergency fleet, a vessel recently launched on San Francisco bay, bears a name selected by the copper camp of Ray, Ariz., the important center of Pinal County, which so distinguished itself in the Fourth Liberty Loan campaign as to be awarded the privilege of naming a ship. Miss Barbara Cates, of Salt Lake City, daughter of Louis S. Cates, former manager of the Ray Consolidated, was to have christened the vessel, but illness in the family prevented, and it was Mrs. A. J. MacLean, of San Francisco, a former resident of Pinal County, who broke the bottle. As a gift from the citizens of the county, the ship will carry a handsome silver service.

Bouquets—We Like 'Em

"Let me congratulate you on the extraordinary improvements in *Engineering and Mining Journal* in the matter of procuring and presenting the mining news of the country. It used to be the *Journal* was read only for the technical or special articles; you are getting it read for the news it contains."

"Many thanks for the information contained in your letter. The data I have obtained from you since the beginning of this year have already proved to be of much more value than the year's subscription, and I have not utilized it much yet either."

"As you know, we have more or less depended upon the technical journals for some of the information which we use in our monthly reports, and your failure to publish, on account of the unfortunate strike, has closed one of our important sources of information, and I wish to thank you for your kindness in helping us out of this difficulty."

"Last week I had the good fortune to spend the whole of three days at home, and during that time I looked over the back copies of *Engineering and Mining Journal*. The last few copies appear and read like a new *Journal* of the profession."

"I wish to express again my appreciation, and that of many others in the Bureau, of the great improvement in *Engineering and Mining Journal*. All of us here feel that the *Journal* is now a real live paper of national interest, which should be read from cover to cover, and not to be glanced at and thrown aside or hastily skimmed through. We feel that you are realizing your idea of making it a national weekly."

"We that are out in the hills have a hard time to gage the course of events, and I value the *Journal's* political comments more than I do those of any individual newspaper."

"Doubtless you receive no end of letters of appreciation, but I want to add mine. I am marooned out here in the mountains with a copper prospect that is one baffling problem after another, and I can sincerely say that I do not know how I could 'keep house' without *Engineering and Mining Journal*."

"I read your *Journal* as most persons read the *Saturday Evening Post* or the *American*, of course, excepting the purely technical engineering articles. Your editorials I give more credit and value than those of any daily metropolitan newspaper, since they give a practical and specialized application of big events affecting the industry of the country. I am saying this because I feel it due the editor to know what others think of his product."

CONSULTATION

Marketing Bismuth Ores

"Can you give me any information which would assist me to market a low-grade bismuth ore carrying silver and copper? If concentrated, whether there would be any other market than the smelting companies? The smelters pay $1 per lb. for the bismuth content, with a market around $2.70 per lb. and this seems to me to be a rather wide margin. What are the uses of bismuth?"

There are very few buyers of bismuth ores, and practically all are smelting companies. The large chemical manufacturing companies buy the metal from the smelting companies and resell it either as metal or in the form of manufactured compounds. The price which you mention is that at which bismuth is sold to the wholesale markets, not the quotation at which the smelter sells to the chemical manufacturing company. According to *The Mineral Industry*, the principal source of the world's bismuth is Bolivia, and the firm of Johnson, Mathey & Co., of London, is the largest foreign producer of the commercial metal.

In 1908, imports of bismuth were 225,833 lb., valued at $313,919, and in 1918 they were 85,611 lb., valued at $208,098. These figures indicate that the bismuth market is small. *Mineral Resources* estimates the extent of the bismuth consumption of the United States to be about 500,000 lb., although this seems to us to be rather large. Almost all of the domestic production is a byproduct obtained in the refining of lead bullion, either by electrolytic or furnace methods. The limited demand for bismuth precludes a close margin between the sales price of the metal and the buying price of the ore. We have no late quotation on bismuth ore. According to one of our informants, little bismuth ore has been bought. Another interested dealer states that bismuth offerings from Western states have been few, but that he would be glad to consider any offerings of such ores. It is further stated that bismuth ores from Western states are too low in grade, although the dealer of whom inquiry was made said that he would consider 20 to 30 per cent ores or those of even lower grade.

The uses of bismuth are relatively few. One important industrial application is as a component of fusible alloys. Occasionally it is mixed with the alloy used in stereotyping and in safety plugs for boilers, automatic fire sprinklers, electric fuses, solders and similar purposes. It is used in the manufacture of bismuth compounds. An extended description on its uses appears in "Mineral Resources of the United States," 1917, Part I, p. 23-35, U. S. Geological Survey.

San Francisco Silver Prices

"For a period of three years or more we have noticed that the actual market sales for silver in San Francisco are from 1 to 3c. above the New York official quotations, and have in some instances been more than 3c. higher. We notice in the *Engineering and Mining Journal* there is published weekly a report on silver prices, and these prices are less than the San Francisco prices, as noted before. There is a note stating that the New York quotations are as reported by Handy & Harman. In fact, these quotations have uniformly been from a fraction to a cent and a fraction below the actual New York market. It seems that the H. & H. quotations have been accepted as official, as the reports made daily by the Equitable Trust Co., of New York, characterize the H. & H. quotations as "official" New York quotations. If you can advise us as to how the H. & H. quotations get the character of "official" we will be very much obliged to you."

San Francisco silver prices are higher than those of New York for two reasons: One is that the express rate on bullion from New York to San Francisco is $8.80 per $1,000 of valuation, or 1 to 1¼ c. per oz. at present prices. The other is, that there exists a market in San Francisco for "prompt silver." There may be a sudden demand for silver to "catch a steamer." Under these circumstances, a special price will be asked by the owners of spot bullion.

The term "official quotation" is one that has grown up by continued use and due to the fact that a number of smelting companies make their silver settlements on the basis of Handy & Harmon quotations. For want of a specific term the quotations acquired the title "official."

The existance of several prices for a commodity such as silver may be explained by the fact that a smelting or other company which buys silver bullion or bullion for refining and sale is under the necessity of selling that bullion. In purchasing from the producer or mining company, the smelter stands in much the same position that a wholesaler does to a producer of raw commodities. In other words, it is the middleman again. The H. & H. quotation is the price paid the producer by the wholesaler; the New York price is the price paid to the wholesaler by the user. A silver producer could engage in the business of selling his silver directly to the user, as does sometimes the farmer to the consumer. In doing so the silver producer would have to engage the services of an agent or hire a salesman to handle his sales of silver to users at the highest obtainable prices. It would undoubtedly pay large silver producers to establish selling agencies, but the smaller companies would probably find it an unsatisfactory arrangement.

Uses for Asbestos

"I have recently discovered on my farm in Virginia a deposit of asbestos, of the amphibole type. Will you kindly advise me if you know of anyone who would be likely to want to buy my output."

Amphibole asbestos is usually long-fibered, but is brittle and weak, and so cannot be used for textile purposes. Chrysotile or serpentine asbestos, on the other hand, is strong, silky, and pliable, and can be spun into yarn and woven into various fabrics. Amphibole asbestos is, therefore, a low-priced material as compared with chrysotile.

If you have a deposit of good quality and of considerable extent, we would suggest that you communicate with the Powhatan Mining Co., Woodlawn, Baltimore, Md., which manufactures filter asbestos, and also with the Fall Mountain Co., 203 South La Salle St., Chicago, Ill., and the American Mineral & Grinding Co., Atlanta, Ga., which handles material suitable for boiler lagging and pipe covering.

THE PETROLEUM INDUSTRY

Mexican Petroleum Industry*

IN YOUR issue of Jan. 3 we regretted to read an article, "The Petroleum Industry," in which Mexico is again being attacked. The article speaks of "offensive against foreign operators," forgetting that the foreign operators (North American) are the authors of the offensive, since they refused to respect the laws of a country which not only received them with friendliness but is giving them riches of which they never dreamed.

The Mexican Government, which, not taking into account that the oil operators can get the help of a nation as powerful as the United States, only looks out for the national interests that have been entrusted to it, is not and can not be called an "irresponsible government." On the contrary, it should be treated with respect, since it has assumed with dignity and energy a responsibility which is tremendous—compared with the military and financial weakness of the nation—and if, assuming this virile attitude, it defends the policy of "Mexico for the Mexicans," we do not think this should be a reason for reproach, as it is only just and rational that each nation follows the ideal that its own soil and richness be enjoyed by its citizens. For this same reason the United States has said and still says: "America for the Americans." We protest against the statement that Mexico is "the sick man of America." And this protest is based upon our national history and the facts which are being realized daily in the reconstruction of Mexico.

Another incorrect statement contained in the article referred to is that "disturbed conditions have practically driven all American metal-mining men out of the country." In the principal mining camps of Mexico, such as El Oro, Pachuca, Tlalpujahua, Guanajuato, and Jalisco, the foreign miners are working under the protection of our laws and continue paying big dividends.

We translate for the information of your readers the following paragraphs taken from the official information given by the Chief of the Department of Petroleum, referring to permits for drilling new oil wells; and I would bring to your attention the fact that permits have already been given, in view of the attitude of the oil companies which seem to be disposed to obey the laws of the country in which they are working:

The important point of deciding who is the proprietor of oil-bearing grounds in Mexico is still awaiting decision. Is it the private owner of the surface, as was believed before, or is it the nation, as is clearly stated by the fundamental law of the republic?

It is logical, natural and customary, in all different kinds of activity, when debating or discussing the propriety of some estate or right, that the interested parties refrain from disposing of or utilizing it in whatever form might be, until the judges or tribunal decide to whom belongs this estate or right. This is precisely what the federal executive has done in the petroleum question; he has ordered in one of his last decrees that the dissatisfied companies or private parties, who insist that they are the owners of the petroleum contained in the subsoil of their owned or rented grounds, do not use this right they believe to possess—that they do not exploit this richness, whose owner they believe themselves to be—until the competent authorities—be it the Supreme Court of Justice, through its decision referring to the protests registered now under revision; be it the General Congress by promulgating an organic law that is being studied—decide definitely to whom corresponds the ownership of the hydrocarbons of the subsoil.

However, the rebellious petroleum companies, especially the North American companies, have protested against this natural and simple condition; against this measure, so legitimate and convenient; against this proceeding so common and frequent; and claim the right to exploit these oil deposits, to seize them and to traffic with them, before the competent persons have decided to whom they belong, and who is their real and legitimate owner. And, doing this, the companies cannot say that they are acting like this, obliged by urgent and painful commercial necessities; that their conduct is justified by reasons powerful and unavoidable. The majority of the companies only want to drill out of unbridled greed, out of a very intense commercial competition and rivalry, out of a fight in which they try to snatch away, one from the other, that which they think belongs to them, without thinking in the least of a rational and careful exploitation of this wealth, without taking into consideration the future of the Mexican nation or the people who dwell upon the grounds they are exploiting.

The majority of the companies who complain of the restrictions for giving permits to drill wells imposed by the government do not exploit or utilize in the least even the fourth part of the petroleum that the wells already drilled produce.

The productive potentiality of all the wells already drilled up to the end of the year of 1918 was 253,218 cu.m. (1,593,000 bbl.) per day, and the oil extracted out of all of them during the same year was 27,800 cu.m. (174,872 bbl.) per day, representing scarcely 11 per cent of the total productive potentiality of said wells.

These data prove that the producing companies, neither collectively nor individually, have an urgent necessity of obtaining more oil in order to comply with their commercial obligations, as they have an ample margin of security, and the day is still far off when they will have sufficient storage capacity and means of transportation to be able to handle all the oil their wells can produce.

It has been stated before that the constitution of 1917 has declared property of the nation all deposits of solid mineral combustibles of petroleum and of all the rest of solid, liquid or gaseous hydrocarbons. Said constitution advises that only Mexicans by birth or naturalization and Mexican companies have the right of acquiring the dominions of land, water and their accessories, or of obtaining concessions for exploiting mines, water and combustible minerals in the Mexican Republic. So that, besides the definitive resolution referring to who should be considered the proprietor of deposits of mineral combustibles, there is to take into consideration the very important circumstance that concessions for the exploitation can only be granted to Mexican companies, organized according to the laws of the country and subject to the law courts of the nation.

The majority of the petroleum companies and nearly all the dissatisfied companies, who have submitted complaints to the Government in Washington, are foreign companies, mostly North American, who have refused to organize branches or subsidiary Mexican companies, with legal capacity to obtain concessions for exploitation.

Besides, the decree of Aug. 12, 1918, in its Article 4, prescribes that those who exploit claims not acquired

*A letter in reply to an editorial in the *Engineering and Mining Journal* of Jan. 3, 1920, p. 33.

according to the decree of July 31, of the same year, only are authorized to continue exploiting the work already begun and under determined conditions, but that they are not allowed to begin new works, until they have made the corresponding contracts, through which they obtain the right of exploiting these new claims.

Thus, the Ministry of Industry, Commerce, and Labor has acted in conformity with the prescriptions of the law, when it did not give permission to make new drillings to companies who had not presented their applications according to the respective decrees; and has done its best not to hamper the development of the industry by reducing the reach of that prohibition, contained in the said decree, as is shown in the following:

Article 4 of the decree is decisive and general. It determines that the parties who at present are exploiting claims can continue to exploit their works already begun and authorized, but that they are not allowed to start new works. Applying literally and strictly this decision, the rebellious companies should not start any new work whatever; but the ministry, taking into account the considerable losses that the exploiting companies would suffer if they were absolutely forbidden to execute any work related to the petroleum industry, has confined itself to only not giving permission to drill wells, as this would affect fundamentally the point under discussion, viz., who is the proprietor of petroleum deposits; and has allowed that the companies undertake other kinds of work, such as construction of storage tanks, pipe lines, pumping plants, refineries, terminals, and piers for loading and unloading.

This policy followed by the ministry shows that the opinion so largely held in the United States of America, first, that the Mexican Government intends to confiscate the oil properties, and, second, that it hinders and obstructs through all possible means the development of the petroleum industry, is entirely erroneous.

The Mexican Government has permitted that all the proprietors of producing oil wells continue to exploit them freely, as it thinks that, since these industrials have drilled said wells and since the latter have yielded oil, they have "de facto" a right to the petroleum that they are producing; and there is not one case that could be quoted in which the government has even intended to seize one of these wells. The decrees only enact that in these cases the nation shall receive a royalty of 5 per cent of the production, in specie or cash, taking the value of the product at the closest shipping point, and deducting the cost of transportation from the well to said point.

All the exploiting parties, absolutely all of them, have continued to dispose of the oil extracted from their wells, after the promulgation of the constitution of 1917, and during all the time in which the decrees referring to taxes upon oil contracts and oil deposits have been issued; and not only this, but the ministry has given them ways and means in order to realize an intensive exploitation of their wells, granting them concessions for the construction of refineries, terminals, submarine pipe lines and everything they have needed for a more extensive and productive development of their property.

The establishment of the port called Puerto de Lobos, on the Mexican gulf coast, half-way between the ports of Tuxpan and Tampico, is a plain proof of this constant preoccupation of the government and of its decided interest in giving the oil industries facilities to transport and export their crude oil and its products. . . .

Moreover, although the Mexican Government has been able to allow the companies to freely exploit their producing wells, and it has given all kinds of facilities for the transport, storage, and loading of their products, it cannot grant permission to dispose of the petroleum contained in the subsoil of the grounds, owned or rented, without seriously injuring the constitutional principle, which declared that said deposits are property of the nation, and still less could it give said permission to the rebellious foreign companies, who declared themselves in open fight against the principle of nationalization of the Mexican petroleum, since such a procedure would be contrary to the mandate of the constitution in force, that all Mexican functionaries have promised to comply with and to enforce compliance, and contrary also to the honor, dignity, and sovereignty of the nation.

In the accompanying table I am giving a list of the producing petroleum companies, indicating the total potential production of their wells, the extraction from said wells during the year of 1918 and the proportion of the extraction compared with the total capacity of production of these wells.

PRINCIPAL PRODUCING PETROLEUM COMPANIES

Proportion of Extraction From Well Compared With Potential Production

Companies	Potential Production Cubic Meters Daily	Potential Production Cubic Meters Per Year	Production in 1918 Cubic Meters	Actual Production Compared with Potential Production, Per Cent
El Aguila	26,590	17,515,350	2,688,497	35.8
East Coast	4,561	1,664,765	549,640	33.0
Freeport	5,755	2,115,175	654,953	31.0
Oil Fields of Mexico	60	21,900	4,755	21.7
Penn. Mex	13,969	5,098,685	1,089,679	21.4
Panuco Boston	1,113	406,245	84,501	20.8
Huasteca Petroleum Co	48,553	17,721,845	3,209,294	18.1
Cortez Oil & Adrian	5,804	2,118,460	343,682	16.2
Chijoles Oil	154	56,210	4,017	7.1
Mex. de Pet. Libertad	8,000	2,920,000	243,561	8.4
The Texas	14,012	5,114,380	203,457	4.1
International	6,661	2,431,265	96,937	4.0
Mexican Gulf	22,370	8,165,050	274,752	3.4
Mex. de Combustible	5,052	1,843,980	47,705	2.6
Transcontinental	15,804	5,768,460	60,736	1.0
La Corona	8,095	2,954,675	53,673	0.8

The list shows that the said companies as a rule do not even extract 40 per cent of the petroleum they could produce, and that these companies have therefor at their disposal a reserve of 60 per cent to comply with their obligations or to enlarge their commercial operations.

The petroleum companies that have a real necessity of drilling new oil wells have a door open to do this. The decree of Aug. 12, 1918, in its Article 4, says that, in order to start new works, it is necessary to make special contracts with this ministry; but the companies, in the haughtiness and intolerance they have assumed in this matter, do not allow that their, what they call, absolute rights to the subsoil deposits of their claims be discussed, nor do they admit any right of the government to impose certain restrictions and to determine special conditions for the exploitation of the petroleum. The foreign companies, especially the American companies, defied the Mexican Government, face to face, power against power; they do not tolerate observations, nor admit any discussion whatever over their acquired right to the petroleum deposits; and the honor and dignity of the nation would gravely suffer if the Mexican Government should yield to the insolent attitude of the petroleum companies.

Much more reasonable is the article "The Mexican Problem," published in your number of Dec. 27, 1919; though it contains grave errors, very common among those who only know our situation superficially, in the supposition that an intervention in Mexico could count upon the support of many Mexicans. Another error consists of attributing to President Carranza hostile sentiments against the United States. President Carranza has followed, in the foreign relations, the policy that would best suit the necessities of the country. Referring to his personal "pro-German" opinion, the truth is that he, in this official acts, never has made reference to Germany; and, in his general policy, he always has been inclined to a benevolent neutrality toward the Allies, since the latter have continued to freely dispose of the Mexican petroleum. As for the Mexicans at large, the intellectuals, the cultivated classes, it is well known that they always had admiration and great devotion for France, particularly during the terrible hazards of the War.

L. PÉREZ CASTRO,
Member Am. Soc. C. E.
P. O. Box 10,093, Mexico City.
S. SULUGUIS, M. E.

April 5, 1920.

Wildcat Drilling in Warren County, Ky.

Surface Conditions Were Favorable, but Exceedingly Hard Dolomite Was Encountered, Through Which the Oil Could Not Seep—Some Shallow Pools Thought To Exist, but Development Will Be Difficult

BY GEORGE A. LAIRD
Bowling Green, Ky.
Written exclusively for *Engineering and Mining Journal*

A WELL recently drilled on the Hubert Graham farm, approximately two miles north of Bowling Green, Ky., was started after a topographical and substructure survey had been made which justified the work, but no commercial quantities of oil were tapped.

Warren County, in which Bowling Green is situated, is on the western flank of the Cincinnati uplift. It lies within the Mississippian member of the Sub-Carboniferous series, which have a dip of approximately thirty feet to the mile in a general northwesterly direction.

Substrata levels, carried from wells drilled in various parts of the county, were carried to the drilling site and the following estimates made:

	Feet
Height above sea level, maximum	537
Height above "Devonian Black" shale at collar of hole	752
Thickness of shale	100
Thickness of Devonian member	305
Depth necessary to encounter Silurian	1,057
Anticlinal uplift	40

Samples of drillings were saved from each "screw" from 400 ft. to 1,055 ft., the ultimate depth, the screws varying from five to seven feet. Three sands were expected, the "sand" of the district consisting of a more or less porous dolomitic limestone. The first was thought to lie immediately below the Black Shale, the second at 887 ft., and the third at 1,037 ft., the Silurian or "blue lime" to occur at 1,057 ft. The driller's log shows the following:

TABLE I. DRILLER'S LOG, HUBERT GRAHAM WELL

	Feet
Conductor, through limestone slabs and clay, set at	43
Blue lime to	75
"Sharp" lime to	100
Water at	143
Gray lime to	205
Blue lime to	300
Gas, strong in sulphur, at	230
Set Casting at	300
Hard shales to	395
Gray lime to	425
Four feet of mud at	439
Good drilling to	495
Little gas at	496
Little gas at	544
Softer at	615
Gray slate at	735
Top of black shale at	748
Bottom of shale at	833
Show of oil at	859
Clay at	935
Harder at	1,027
Blue lime at	1,055

From a cursory examination of the drillings with the ordinary hand glass, the data given in Table II was obtained.

That the anticipated possible oil-bearing structure above the average in thickness exists, is beyond doubt, but in place of sands or porous dolomite a greatly hardened material was encountered.

The well made about one gallon of oil per twenty-four hours. The rock pressure, although not determined, is evidently very high, and in a manner accounts for the flowing or "blowing" of some of the wells in the district contiguous to Bowling Green.

Authentic reports of wells drilled many years ago, as well as a number drilled in more recent years which have been allowed to stand with the casing and tubing intact, indicate that this high rock pressure is responsible for the flow, the amount of the latter being in direct proportion to the amount of seep through the exceedingly tight dolomite. Several wells which have failed to yield more than a barrel on the pump are known to have built up a pressure in the shut-off tubing sufficient to eject comparatively large quantities of oil when released, then to remain dormant for several weeks or months, and subsequently to repeat the "blow."

TABLE II. LOG OF GRAHAM WELL, FROM DRILLINGS

Samples of	Feet
Gray crystalline limestone, strong odor of sulphur and petroleum	215 to 220
Traces of petroleum ("Rainbow")	220 to 225
Slaty blue-brown limestone	225 to 230
Brown aerenaceous limestone	235 to 240
Gray limestone, massive	240 to 420
Calcareous clay, nodules of chert	420 to 425
Calcareous clay	425 to 430
Gray-blue slaty limestone	430 to 490
Gray talc, stained with iron oxide	490 to 495
Slight flow of gas	495 to 500
Gray crystalline limestone, very hard	500 to 510
Hard blue limestone	510 to 550
Gray slaty limestone	550 to 575
Dark gray slaty limestone	575 to 600
Gray limestone, massive	600 to 620
Gray limestone, slaty	620 to 651
Light gray limestone, massive, slaty	651 to 679
Light gray limestone, shaly	679 to 701
Darker gray, shaly	701 to 726
Green, magnesian (Dolomitic?)	726 to 747
Penetrated "black shale" (Devonian)	747 to 763
Black shale	753 to 833
White magnesian limestone (Dolomitic)	833 to 843
Brown limestone; showing of oil. (This is the true "Corniferous" limestone of the Devonian series)	843 to 859
Brown and white limestone	859 to 870
White limestone, very hard	870 to 885
Showing of oil, very hard (seven hours were required to drill two feet)	885 to 901
Very hard, specks of pyrite, chalcopyrite, and possibly galena	901 to 906
Very hard gray limestone	906 to 922
Talcy, nodules of gray limestone	922 to 935
Gray lime, massive, hard	935 to 1,050
Bottomed in blue limestone (Silurian)	1,050 to 1,055

The shooting of any of the wells which have no porous sands is of little or no avail. Production must be secured from some other source, and there is no surface indication which can be used as evidence that a porous substructure exists.

Oil secured from both above and below the shale in the shallow pools about fifteen miles to the east is of the same origin as that secured from the Graham farm, but carries a much higher sulphur content. That from above the shale is from the deeper-seated zone, crevices due to faulting, combined with high rock pressure, allowing for the transposition to the upper strata.

The district is difficult for geological work. Sink holes, varying in size from mere pot-holes to those several acres in extent, are abundant, and changes in the same strata in comparatively short distances make accurate determinations of the horizons of the substrata difficult. There is no reason to doubt the existence of paying pools, but many dry holes may be drilled before they are developed. The shallow pools developed under conditions like unto those to the east do not as a rule prove lasting, and the more promising territory for profitable development is apparently along the general dip of the series, to the west.

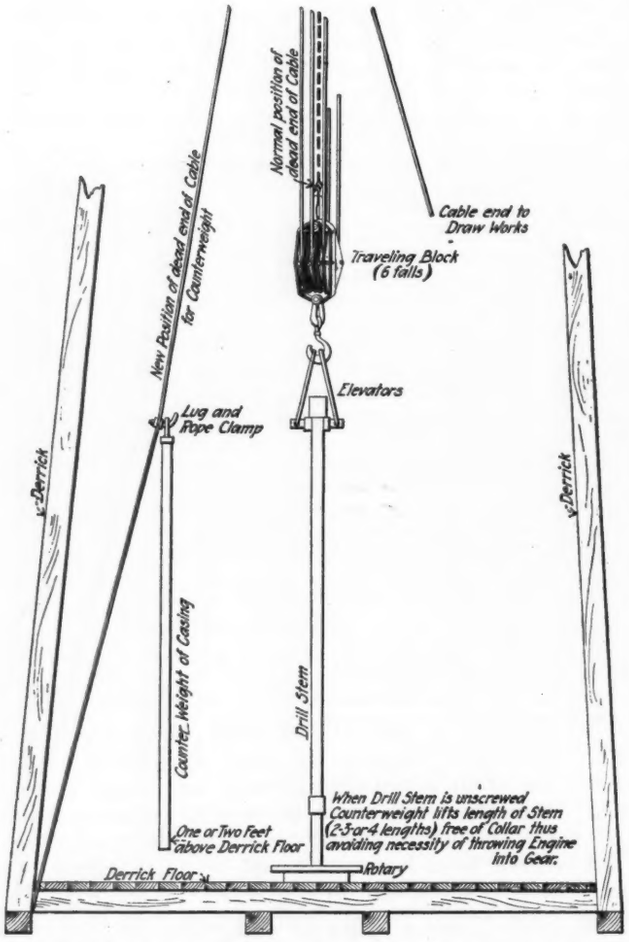
Counterweight on Dead Line

A Time-Saving Device in Rotary Well-Drilling—Its Construction, Operation and Advantages In Decreasing Wear on Threads

Written exclusively for *Engineering and Mining Journal*

SPEED in oil-well drilling is usually desired. In contracting, it is essential; hence, many little schemes are devised to facilitate the work. One of these speeding-up devices, used extensively on rotary rigs in the oil fields, is a counterweight on the dead end of the drilling cable.

Before attaching the weight, the dead end of the cable, instead of being attached to the top of the traveling block, is carried over to the front right corner of the derrick, from the driller's usual station, and


Normal position of dead end of Cable
New Position of dead end of Cable for Counterweight
Cable end to Draw Works
Traveling Block (6 falls)
Elevators
Lug and Rope Clamp
Derrick
Derrick
Counter Weight of Casing
Drill Stem
When Drill Stem is unscrewed Counterweight lifts length of Stem (2-3 or 4 lengths) free of Collar thus avoiding necessity of throwing Engine into Gear.
One or Two Feet above Derrick Floor
Rotary
Derrick Floor

COUNTERWEIGHT ON DEAD-LINE OF DRILLING CABLE

fastened to the corner of the derrick foundation. The counterweight consists usually of one or more lengths of casing of different sizes slipped into each other, so that the device is only as long as one piece of casing. The total weight is varied according to the number of lengths of drill stem to be "broken down" (removed from the well) at a time. When "breaking down" in "triplets" or "fourbles" (three or four lengths of drill stem together) a greater weight is required than when "breaking down" in "doubles." Conversely, less weight is required with a triple (six-fall) block than with a double (four-fall) block. For a light counterweight, a length of 4-in. casing may be used, a 6-in. is heavier, and a 4-in. inside a 6-in. is still heavier or a plug may be put in the bottom of the 6-in. casing and the length filled with water.

To suspend the counterweight of casing, a hook-shaped lug is attached to the drilling cable by a wire-rope clamp, at a slightly greater height above the derrick floor than the length of the casing. Then a bail of wire is fastened around the top of the casing and passed over the hook. With this suspension, the counterweight can be readily released when necessary.

The counterweight serves two purposes: It speeds up the work of "coming out" of the well, that is, removing the drill stem, for it picks up whatever length of drill stem is being unscrewed the moment the threads have released. The length then needs only to be pushed to one side and stood up in the derrick, whereas, without the counterweight, the engine would have to be thrown into gear each time to pick up the drill stem unscrewed, and considerable time would thereby be lost. The other advantage is that the weight of the drill stem is lifted off the threads at the joint being unscrewed, and the wear on the threads is considerably decreased. This counterweight device increases the rapidity of breaking down in any case, but especially where tool joints are used.

Ancient Shore Lines and Oil Pools

IN A RECENT article in *Economic Geology*, William F. Jones points out that "Underlying the structural theory, regardless of structural type, lies the postulate that oil migrates considerable distances; up the dip if water be present, down the dip of water be absent; in each to the water surface or until further migration is impeded by the pinching out of the sand, closed fault plane, or other obstructions. This simple process of accumulation undoubtedly takes place where conditions are right as regards size of pores in the sand, viscosity of the oil, and sufficient dip of the roof of the porous bed. Just what the necessary dip is for any set of conditions of porosity and viscosity is unknown. That there is a limiting angle of dip is evident, and this point is admitted by Clapp in the structural classification, in that there is inserted what is called subaclinal structure where there is 'too slight a dip to fully separate the oil and gas from the accompanying water.'"

Mr. Jones proceeds to question the extent of lateral migration of oil as well as its movement up the dip, and states that he is in agreement with A. W. McCoy that, "except under special conditions, there is no wide lateral migration of oil in the process of its accumulation," and that "oil pools have only slight and indirect relationship to so-called structures such as terraces, anticlines, and domes in regions of low dip."

He goes on to suggest that "there is a great deal of evidence to show that the individual oil pools of the Appalachian and the Mid-Continent regions do not conform in general to structural deformations, nor do the pools result from migration due to dip of beds, but bear a close configuration of the ancient shore lines in each case."

Though Mr. Jones limits his deductions to the Pennsylvania and Oklahoma regions, they are suggestive enough to warrant considerable study in relation to other fields. The simple anticlinal theory as an explanation of oil accumulations in regions of accentuated dip has served the purpose of directing attention to struc-

ture. The cumulative observations from many fields bring out the fact that structure is a degree element and that many other factors must be taken into consideration. Whether ancient shore lines bear an important relationship to the present position of oil pools or not is an interesting conjecture. Five conclusions are selected from Mr. Jones' summary, and they raise the question as to how far they may apply to regions other than the Pennsylvania and Oklahoma. They are:

1. The oil has accumulated in near-by porous beds either by the porous bed or beds being in direct contact with the source of supply or by fracturing, as suggested by McCoy, if the two are not in contact.

2. No wide lateral movement of oil has taken place, and present position and shape of oil pools closely conform to the underlying or overlying source of supply.

3. The areas of supply are lagoonal regions close to and generally parallel with the coast line at the time of deposition.

4. A detailed study of paleography and a delineation of ancient shore lines would prove of considerable value in directing the major drilling developments.

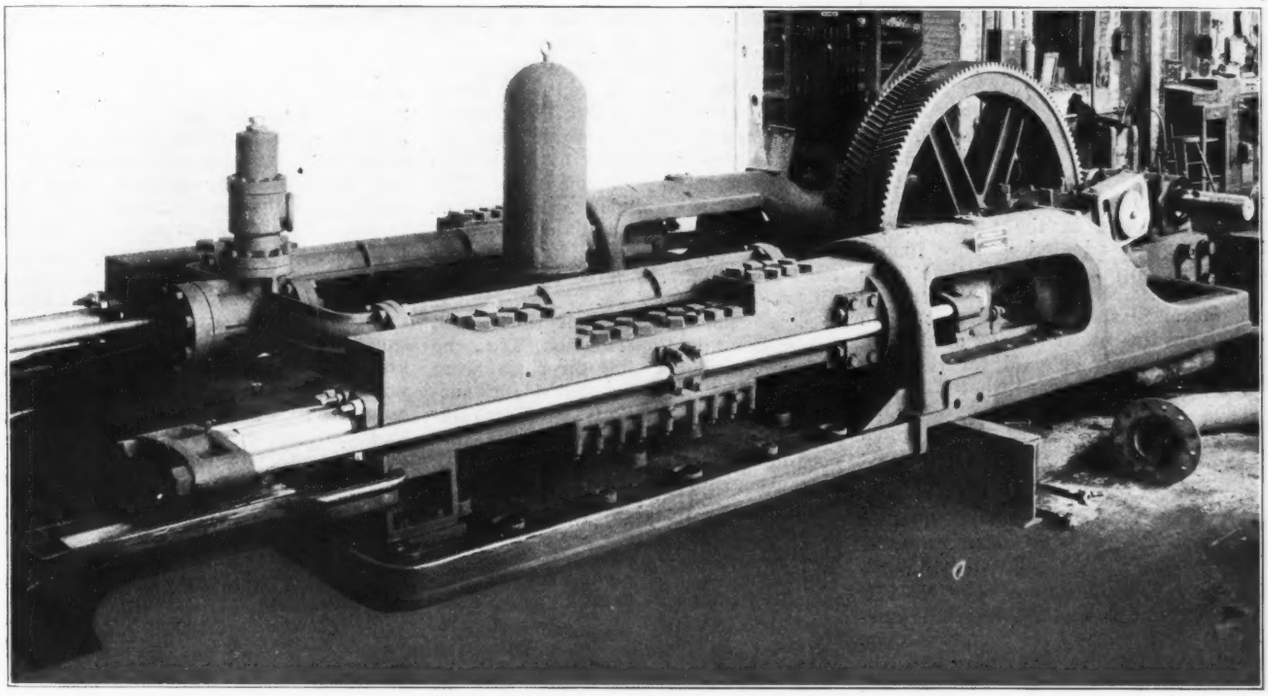
5. There may be extensive areas of favorable oil land in regions condemned at present because of the lack of so-called favorable structure.

Pumps for Oil Pipe Lines

The White Oil Corporation and the Sims Petroleum Co. propose to install in the Southern states two pipe lines, each approximately 300 miles long. The pipe line of the White Oil Corporation is in Texas, starting in the Ranger field and ending at Texas City. The pipe line of the Sims Petroleum Co. starts in the Homer field, Louisiana, and ends between Baton Rouge and New Orleans. Both pipe lines are to be used as the means of transportation for crude oil from the oil field to the refinery at tidewater.

One of the features in connection with the two pipe lines is the fact that both will be equipped with the same size and type of pumping units manufactured by the Worthington Pump & Machinery Co. Owing to the great number of units, the two pipe lines and their equipment used will represent a high standard for pipe-line practice, which will undoubtedly influence other similar constructions for some time.

The pumps are of a comparatively recent design for this class of work, being of the forged-steel fluid-end type, with outside end-packed plungers. They are all 5¼ x 18 in. horizontal duplex power-driven machines, designed to have a capacity of 9,000 bbl. of 35 deg. Bé. oil per twenty-four hours when operating at a speed of 40 r.p.m. The pressure against which the pumps will operate is 700 lb. Each of the pumps is connected to a 150-hp. Worthington Snow type single-cylinder four-cycle horizontal Diesel engine through a single reduction of cast-steel herringbone gears and flexible coupling. The engines operate at a speed of 165 r.p.m., and are equipped with speed-changing governors so that the speed can be varied when required down to 120 r.p.m. This changing of the speed of the engines is a desirable feature, in order to prevent an increase in pipe-line pressure above the 700 lb., which might be caused by increased friction due to congealed oil.



HEAVY-PRESSURE PUMP FOR OIL PIPE LINES

In the design of the pump, many of the difficulties of the pot-valve form of construction were avoided by cutting the oil-end out of a solid block of forged steel, thus avoiding joints under pressure and securing a more homogeneous metal in the walls of the plunger chambers. The valves, which are small, are of the ball type. The illustration shows a slightly larger pump than those used upon both pipe lines.

[According to our correspondent in Texas, the construction of several oil pipe lines there, probably including the two described in the foregoing, has been postponed. See *Engineering and Mining Journal* of April 17, 1920, p. 939.—EDITOR.]

NEWS FROM THE OIL FIELDS

Oil and Gas Leases in Alaska

Liberal Lease Terms Made—Oil Prospectors Encouraged by Low Royalties

Regulations prescribing the royalties and rentals under oil and gas leases in the Territory of Alaska, Act of Feb. 25, 1920, have been issued by the Department of the Interior. The act recognized that conditions in Alaska warrant liberal terms, prospectors being given double the time for exploratory operations compared to that granted in the States, and the Secretary is authorized to waive the payment of any rental or royalty for the first five years of any lease. Under this authority, and having in view the harsher conditions attendant upon prospecting and development in the remote districts where oil indications are found in the territory, the Secretary has adopted a more liberal scale of royalties and rentals than those fixed for the States. The rules and regulations issued provide that upon leases granted under Sec. 22 of the act, no royalty shall be paid for the first five years, except in case where the producing wells yield an average of 100 bbl. or more per well per day, in which case the royalty is fixed at 5 per cent; for the second five years after date of lease the royalty is fixed at 5 per cent, and for the succeeding ten years at 10 per cent.

Upon leases granted in Alaska under prospecting permits, Sec. 14 of the act, the permittee is given a lease for one-fourth of the area of the permit without royalty for the first five years and will be required thereafter to pay 5 per cent upon all oil produced. On the remaining lands to which the law gives him a preference right he is not required to pay royalty for the first five years, except in those cases where the wells yield an average of 100 bbl. or more per well per day, paying in that case 5 per cent royalty; for the second five years a royalty of 5 per cent is prescribed, and for the succeeding ten years a royalty of 10 per cent. Where the wells upon a claim average less than 10 bbl. per well per day, no royalty is prescribed. Lessees under both the relief and prospecting sections are relieved from the payment of any rental during the first five years succeeding date of lease. Thereafter, they will be required to pay a rental of 10c. per acre per year, in advance, rentals, however, to be credited upon royalties accruing for the year. Rentals on gas, if any be produced, are not fixed, but will be prescribed in each lease issued.

In February, 1920, Mexico exported to the United States 4,939,912 bbl. of crude petroleum, of a value of $2,447,431, as against 3,655,547 bbl., of a value of $1,799,489, in February, 1919.

Texas Oil Fields

Notable Well at Hull—Explosion at Magnolia Refinery — Meeting of Crown Oil & Refining Co.

The "top flow" of Gulf Coast wells is usually short-lived, but one well at Hull, Liberty County, Tex., has been making a remarkable production. This is the No. 2 Palmer of the Texas Co. It was brought in about the middle of February, and up to the end of March had made over 200,000 bbl. It is still flowing over 3,000 bbl. daily.

An explosion under the receiving station of the Magnolia refinery, Beaumont, on the night of April 9, resulted in the instant death of three men, the death of two later from burns, and in the serious injury of one man. The men were working under the building on a pipe line at the time of the explosion. The cause is not known, but the accident is thought to have been due to an accumulation of gas.

At a recent meeting of the Crown Oil & Refining Co., Houston, Tex., the following officers and directors were elected: H. B. Moore, president, succeeding G. E. Colvin; H. F. Montgomery, vice-president and secretary, succeeding J. W. Colvin; C. E. Robinson, treasurer; directors, H. B. Moore, H. F. Montgomery, R. R. Kelly, C. E. Robinson, F. W. Parker, R. A. Searle, and J. C. Stribling. Of these, H. F. Montgomery and J. C. Stribling are the only members of the old board, the retiring members being G. E. Colvin, J. W. Colvin, P. J. White, Thomas White, and R. L. Young. J. W. Colvin will take charge of the company's export business, with office in New York City. The Crown refinery is handling 5,000 bbl. daily.

Huntley Field, Montana

The Huntley field, in Yellowstone and Big Horn counties, Montana, is described in U. S. Geological Survey Bulletin 711-G, "Geology and Oil and Gas Prospects of the Huntley Field, Montana," by E. T. Hancock. It is in reality an eastward extension of the Lake Basin field, described by the same author in U. S. Geological Survey Bulletin No. 691-D. Rich alluvial deposits and gravel terraces border the Yellowstone, while south of the river the interstream areas are commonly high table lands. Surface rocks include strata of the Colorado, Eagle, Claggett, Judith River, Bearpaw, Lance, and Fort Union formations, with later gravels and alluvium.

The long narrow zone of faults extending across the Lake Basin field was observed to continue eastward across the Huntley field, demonstrating a belt almost 100 miles in length. Some structural features favorable for oil are pointed out.

Mexican Petroleum Production

Daily Output—Drilling by American Companies in Tepetate, Chinampa, and Amatlan

On Nov. 1, 1919, according to "Commerce Reports," 305 wells were actually producing in Mexico, the daily production from which is estimated to be 317,000 cu.m., or approximately 2,000,000 bbl. as a maximum and 1,000,000 bbl. on the basis of steady production.

Although the Mexican Government was obliged to suspend the drilling of fifteen wells which had been begun by American companies which did not see fit to respect the dispositions of the law, the recent decree of the president authorizing issuance of permits to drill new wells has already been taken advantage of by many American companies. The greatest activity will be in the regions of Tepetate, Chinampa, and Amatlan, where the petroleum fields are divided into many small holdings, and where, as a result, competition is keen among the different operators. As it is feared that salt water will continue to appear in the petroleum deposits in that section, it is likely that the companies will lose no time in exploiting this region, which is said to be one of the richest in the Mexican oil fields.

British Oil Interests in Western Canada

The Anglo-Dominion Petroleum Co. will this year begin operations on a large scale on the Athabasca River, Manitoba. The company, which is financed by important British oil interests, has an initial capital of $500,000, which will be increased to $25,000,000 in August, the funds being already subscribed and held by British banks. A. S. A. Coyne, managing director and Canadian financial commissioner of the company, is now in Winnipeg.

Eleven geologists in the service of the company, headed by H. Sligand, F. G. S., and J. Romanes, are examining the sites selected by Mr. Coyne for thirty wells which are to be sunk in September. It is expected that the average daily yield of these wells will be between 5,000 and 10,000 bbl. It is stated that one well at House River, in the Athabasca River district, spouted 500 bbl. in seven minutes on Oct. 18 last. Piping valued at $1,000,000 and thirty drilling outfits are held by the company under option and will be forwarded to Canada in time for the commencement of operation in September.

According to "Commerce Reports," the Australian Commonwealth has recently offered $48,665 to be paid for the discovery in Australia of petroleum in commercial quantities.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Shall Aliens Own American Minerals and We Be Denied Foreign Holdings?

Mining and Metallurgical Society of America Members To Vote on This Important Question by Means of Postal Ballot

Members of the Mining and Metallurgical Society of America are expressing by postal ballot their stand on the following resolution which the society's council is sending out:

"Resolved—That the Mining and Metallurgical Society of America herewith petitions the Congress of the United States to safeguard the rights and interests of American investors, whether actual or prospective, in foreign mineral industries, by providing by statute that no citizen or subject of any country which requires by law, regulation, or otherwise any stipulation in any contract, lease, sale, or other agreement, relating to mines or minerals, including petroleum, in the said country or its possessions or dependencies, which prevents or prohibits American citizens because of their nationality, from being shareholders, or which limits the number of shares which may be held by American citizens in such undertakings, or which, because of nationality, places restrictions on American citizens holding any position in the company or on the board of directors or similar control body, shall be permitted to hold either directly or indirectly any right, title, or interest, in any mine or mineral deposit, including petroleum, in the United States or any of its dependencies, or to act on the board or in any managerial capacity whatsoever in connection with any company having any right, title, or interest whatsoever in mines or minerals in the United States or its dependencies, so long as the restrictions before mentioned shall remain in force in any law or regulation or in any contract, lease, or other agreement to which the government of the foreign country or any of its officials or representatives is a party; and be it further,

"Resolved, that no alien company which by its articles of incorporation or association, statutes, by-laws, or in any other similar manner prohibits American citizens, because of their nationality, from being shareholders, or which limits the number of shares which may be held by American citizens, or prohibits American citizens from holding any position on the board of directors in the company, shall be permitted to hold either directly or indirectly any right, title, or interest in any mine or mineral deposit, including petroleum, in any part of the United States or its dependencies."

A. A. A. S. Members Organize a Southwestern Division

On April 10 a number of scientists and engineers met at Tucson, Ariz., for the purpose of organizing a Southwestern Division of the American Association for the Advancement of Science. Prof. E. L. Hewitt, of Santa Fe, New Mexico, was elected president; Dr. E. C. Prentiss of El Paso, Texas, vice-president and chairman of the executive committee; Dr. A. E. Douglas of Tucson, secretary-treasurer. The delegates were Dr. D. T. MacDougal of Tucson, Dr. E. C. Prentiss of El Paso, R. S. Trumbull of El Paso, Dr. D. J. Clark of Albuquerque; A. L. Flagg, mining engineer, of Phoenix; Dr. C. T. Vorhies of Tucson and Dr. A. E. Douglas of Tucson. The foregoing delegates with Arthur Notman, mining engineer, of Bisbee, Ariz., and Fabian Garcia of Mesilla Park, N. M., were chosen as members of the executive committee.

New York Electrical Society Addressed by M. A. Whiting

The New York Electrical Society held its April meeting on the 21st of that month. The paper of the evening was by Max A. Whiting, of the power and engineering department of the General Electric Co., Schenectady, N. Y. Mr. Whiting spoke on "Electricity in the Production of Iron and Steel," tracing the iron from its state as raw ore entering the mills, through smelter and fabricating plants to the principal finished products. Steel mill machinery was discussed, and the manner of using electric drive in operating the various types was shown by illustrations.

Swedish Engineers Urged To Take More Active Part in Public Affairs

At the meeting of the Swedish Technological Association, held at Stockholm on March 23 last, the chairman referred to the disordered condition of affairs abroad and the general desire for a lasting peace. He warned engineers against continuing in the old ruts of their profession, pointing out that a new era had dawned and that they must lay out new roads of endeavor, and that, above all, it was necessary for engineers to keep their own ranks closed up and maintain mutual loyalty. The chairman said that in all lines the modern tendency is toward mass production, and that in this respect the engineers also must give of their best for the general good of their common country. The Crown Prince of Sweden attended this meeting.

Engineers in New York May Prepare Legal Contracts for Their Work

The New York Court of Appeals recently handed down an opinion by Justice F. E. Crane of that court, which seemed to restrict the drawing of legal documents to persons possessing the right to practice law. This raised the question in the minds of some engineers as to whether engineers and architects could continue, in New York State, to prepare contracts and certain other legal or semi-legal documents, as has been their practice heretofore. The American Society of Mechanical Engineers appealed to Engineering Council, which referred the question to Parker & Aaron, of New York City. These legal authorities replied on April 15, 1920, to the effect that "while an individual who is not admitted to practice must not assume the character of an attorney-at-law," there is nothing to prevent a layman as such from drawing a simple instrument. They conclude as follows:

"Engineers having special knowledge of the engineering work required and the professional skill enabling them to express it, are not precluded as an incident in the practice of their profession from preparing 'contracts for engineering work as has been the common practice for years.' By so doing they are not holding themselves out as practicing law and are not practicing law."

British Non-Ferrous Metals Research Association Organized

The scheme for industrial research formulated by the Imperial British Government has crystallized into the policy of encouraging each industry to organize for itself an association which should establish information bureaus and direct and control all research and experimental work affecting the welfare of that industry. These Research Associations, as they are called, are limited-liability companies, working without profit, and with a nominal guarantee from their members, in place of shares.

The British Non-Ferrous Metals Research Association, which has just perfected its organization, includes in its province all the non-ferrous metal industries of Great Britain. Its objects are (1) to spread technical and scientific information among its members; (2) to conduct pure scientific research after new knowledge; (3) to conduct industrial research in order to learn how to utilize the results of pure scientific research. The annual subscriptions run from £25 to £200.

COURT DECISIONS IN MINING CASES

By Wellington Gustin

Tri-Bullion Smelting & Development Co. in N. Y. Court of Appeals

Wiley Treasurer Uses Novel Methods To Get Mining Company's Money—Responsibility of the Directors—Where Bank Is Not Liable for Loss

In the case of the Tri-Bullion Smelting & Development Co. against Curtis and others of its former directors, now before the New York Court of Appeals, a motion had been made upon the ground that the court has no jurisdiction to entertain the appeal and upon the further ground that no undertaking had been filed, as required, with the second notice of appeal. The court granted such motion, unless within ten days the directors file and serve the undertaking necessary to perfect the appeal under the second notice.

The company was an Arizona corporation and carried on mining operations at two different points, one at mines known as the "Kelly Group," at Kelly, N. M., and the other at mines known as the "Nitt Group," at Kelly, N. M., a distance of three-quarters of a mile from the Kelly group. The company also owned two other mining projects, one in Montana and the other in Arizona, but these do not appear to have been developed or productive. In the latter part of 1912, the mines were running at a loss, and operations were discontinued in both the Kelly and Nitt groups in May or June, 1913.

The company employed a general manager at its base of operations, who O. K.'d vouchers and made expenditures at the mines, but a business office was maintained in New York City and occupied by the president and the treasurer. The treasurer began to secure the company's money by the manipulation of checks, and from February 21, 1913, to March 10, 1915, the aggregate sum of $31,776.67, made up of twenty-seven different items, was misappropriated by the defaulting treasurer, Harry J. Clark.

Clark apparently had two methods in appropriating the company's money to his own use, said the Appellate Division of the N. Y. Supreme Court. One of the methods, by which seventeen withdrawals were made from the company's depository banks, was to prepare a check, payable either to bearer or to cash, and send it by the stenographer to the bank to be cashed. Clark then evidently drew corresponding checks, of even date with those used in withdrawing the money, payable to fictitious persons at distant points. As soon as the canceled check, upon which money was actually paid to bearer, or to cash, or in whatever way he was able to get money from the bank, was returned, the check thus used was destroyed, and the check of even date and amount, drawn to a fictitious payee and duly camouflaged with the indorsement of the payee and banking institutions through which the check had apparently passed until returned to the company's office, was substituted. These fraudulent vouchers were, of course, to be exhibited to the company's directors or auditors, if called for.

The other methods practiced in the twelve remaining items of peculation was somewhat different. The cancelled checks were shown to have been paid by the depository bank, but after they were paid they had been altered, by erasing the name of the payee, in the place of which had been typewritten the name of a fictitious payee, and the same camouflage as to endorsements by the payee and the various banks was placed upon the back of each check.

During its activities the expenditures of the company were chiefly at its mines in Arizona. The fraudulent transactions were covered by withdrawals purported to be made in payment of current expenses.

All bills for expenses of operation were required to be approved by the company's general manager before payment. So the treasurer prepared bills for the items covered by the spurious checks, in the names of the fictitious payees; forged the signature of the manager, approving said bills, and filed the same among the company's papers. In the company's books of account fictitious entries were made.

This system entirely escaped detection by the board of directors, and the legal action was brought by the corporation to recover from the directors, and a judgment was entered against the directors, based upon their negligence.

As for the banks, the court said that though they may primarily pay and charge to the depositor only such sums as are duly authorized by the latter, if the depositor is guilty of negligence, which contributed to such payments, and the bank itself has been free from negligence, the bank may be relieved from liability.

Again, if the president and directors of the company furnished the treasurer a quantity of checks countersigned in blank, and permitted him to fill out and use the same as the business of the corporation required, they were grossly negligent, and are responsible for loss resulting therefrom. And the court held, further, that the directors were clearly negligent in failing to hold meetings of the board, as required by the bylaws, and in failing to obtain from their treasurer, who has misappropriated moneys of the company, a statement at each meeting of the financial condition of the corporation.

Fraud Vitiates Leases

Misrepresentations in Securing Oil and Mineral Rights Justified Cancellation in a Court of Equity

In an action brought by certain lessors to cancel oil and mineral leases, the Supreme Court of Oklahoma has held the facts sufficient to justify cancellation on the ground of fraud by the lessee in procuring the leases. It appears the lessee was procuring leases in and about Newkirk and Ponca City, and about the time oil was struck by operators on the Thompson farm, in the vicinity, he made a trip to see the lessors in McPherson, Kan., who owned valuable lands near the Thompson well. Lessors did not know oil had been found in the Thompson well, and the lower court found that lessee told them the well was dry. Lessee thus secured the leases, and when lessors found the well was not dry, they brought this action to cancel the leases.

The lessee contended he knew nothing of the discovery of oil at the time he secured the leases, and was convinced the well would be dry, and that he gave lessees only his opinion in the matter. He had not visited the Thompson drilling for two weeks before he procured the leases, and he maintained that all indications were that the hole would be dry.

The fraud complained of consisted in the representations that the well was a dry hole, with knowledge that the contrary was true. The trial court decided against the lessee, and ordered the leases cancelled, although there was a sharp conflict in the testimony of both sides.

On the question of fraud the court quoted Black on "Rescission and Cancellation": "Fraud is said to be a generic term, which embraces all the multifarious means which human ingenuity can devise, and are resorted to by one individual to get an advantage over another by false suggestions or by the suppression of the truth. No definite and invariable rule can be laid down as a general proposition defining fraud, as it includes all surprise, trick, cunning, dissembling, and any unfair way by which another is cheated. The only boundaries defining it are those which limit human knavery."

Again, the court said that in cases of purely equitable cognizance the judgment of the trial court upon the facts will not be disturbed on appeal, unless it appears that the judgment rendered is clearly against the weight of the evidence. And after examining the record it could not say the judgment rendered by the trial court was against the clear weight of the evidence. Therefore, the oil leases in controversy were ordered cancelled.

THE MINING NEWS

LEADING EVENTS

Situation at Butte Becoming Normal

Hoisting Resumed — Federal Troops Patrolling Roads to Mines—Metal Crafts and Engineers Refuse To Strike

The mining situation in the Butte district is rapidly becoming normal. Hoisting of ore has been resumed and conditions within a few days will be the same as before, mine managers believe. United States troops, who were sent to the scene at the request of the Governor, are patrolling the thoroughfares leading to the mines and the miners are returning to work in steadily increasing numbers. The shooting of fifteen I. W. W. on April 21, one of whom is dead and two more in critical condition, has had a sobering effect upon the members of this organization and the clubbing of 120 more on the following day no doubt converted some of the I. W.W. to believe that Butte is growing too hot for them and many are leaving. Picketing ceased the morning following the shooting.

The metal crafts voted not to join the strike and the engineers refused even to take a strike vote. The strike was unpopular from the first and was declared by the I. W. W. with the idea of attempting to start a movement for revolution, the foreign women wearing red ribbons.

Tonopah Wobblies Out Again and Back Again

Seventy Per Cent Obey Call But Many Return When Strike Is Declared Off—No Demands Made

The "wobbly" element at Tonopah and Divide called a walkout of miners in these districts of Nevada on April 22 without presenting any demands. About 70 per cent responded. All craftsmen remained at work. Two days later on April 24 the leaders declared the strike off and many of the men returned. About 50 per cent of the normal number reported for work at the mines on Monday, April 26.

No demands were made and most of the men appeared ignorant of why they were called out. Although seemingly satisfied with their jobs they were apparently willing to quit work upon instructions from their leaders. No concessions were granted by the companies.

A general strike was called in the Tonopah and Divide districts on August 17, 1919, which lasted until Oct. 4. It failed, the $1 increase in wages asked being refused. A working agreement was issued Nov. 10 by the companies.

Minerals Separation Hearings Before Federal Trade Commission Opened in New York

John Ballot and Dr. S. Gregory Testify How Infringers of Patents "Atone" and Are "Shriven"—Reticent About Profits —Flotation Jolly Simple, Says Gregory

The hearings in the Federal Trade Commission's proceeding against Minerals Separation, Ltd., Minerals Separation North American Corporation, Beer, Sondheimer & Co., and other respondents, whom the commission has charged with suppressing competition by an oppressive system of license agreements with mining companies throughout the United States, began in New York on April 7 and continued through April 16.

John Ballot, the first witness, testified that he is a British subject residing in the United States, and has been connected with the various Minerals Separation companies from the beginning. Mr. Ballot is chairman of the three British Minerals Separation companies and is president of the Minerals Separation North American Corporation.

Minerals Separation, Ltd., the parent company, was organized in London in 1903 for the purpose of developing processes of ore concentration. This was two years prior to the investigation of the flotation process in the laboratories of Sulman, Picard and Ballot. In 1910, it was decided to exploit the patents obtained for this process in the United States, and accordingly Minerals Separation American Syndicate, Ltd., was organized in London with a capital of £52,500. This corporation acquired the American rights to flotation patents, and worked in conjunction with Beer, Sondheimer & Co., who became its American agents in 1911.

Beer, Sondheimer & Co. was a German firm, with its principal office at Frankfort, Germany, and one of the Sondheimers was a director in the American Syndicate. The German firm was also one of the three stockholders of the American Syndicate, the other two being Minerals Separation, Ltd., and Lazard Brothers of London. Benno Elkan and Otto Frohnknecht were the local representatives of Beer, Sondheimer & Co. in New York.

In 1913, need for additional capital was felt in connection with the American venture, and accordingly Minerals Separation American Syndicate (1913), Ltd., was organized with a capital of £250,000, taking over all the business of the first American Syndicate. At the outbreak of war, Beer, Sondheimer & Co., of Frankfort, owned 32,615 shares in this (1913) syndicate. Its principal stockholders, in September, 1916, were Beer, Sondheimer & Co., of Frankfort, Elkan and Frohnknecht of Beer, Sondheimer & Co.'s New York office, Lazard Brothers, of London, and the parent company. By that time, the Public Trustee of Great Britain had intervened and seized the stock interest of Beer, Sondheimer & Co., of Frankfort.

War-Time Rearrangements in Minerals Separation

At the outbreak of the war, Minerals Separation American Syndicate (1913), Ltd., found itself a British company represented in the United States by Beer, Sondheimer & Co., an enemy German firm. English counsel, Sir Frederick Smith, now Lord Chancellor of England, advised that continuance of any agency relations with the New York representatives of Beer, Sondheimer & Co. was very dubious, but the problem was taken up with British authorities in connection with the "Trading with the Enemy Act," and after the agency agreement with Beer, Sondheimer & Co. had been changed in several respects in deference to British regulations, exclusive agency relations with Elkan and Frohnknecht, the New York representatives of Beer, Sondheimer & Co., were continued until the latter part of 1916. Later, in 1916, 17,500 shares of (1913) Syndicate stock were issued to Elkan and Frohnknecht in commutation of their exclusive agency commissions, past and future.

In 1916, for the purpose of obtaining the advantages of American status, it was deemed advisable to have the American business conducted by an American corporation, and to this end Minerals Separation North American Corporation was incorporated on Dec. 7, 1916, under the laws of Maryland. The new corporation rented part of Beer, Sondheimer & Co.'s office at 61 Broadway, New York, and acquired all the American rights and took over all the Minerals Separation business heretofore transacted by Beer, Sondheimer & Co. and the American Syndicate. Part of the arrangement was that Elkan and Frohnknecht should acquire 35,000 voting trust certificates in the new company, and become its "general agents," which voting trust certificates and all dividends thereon should be held for their benefit by the Guaranty Trust Co., of New York, and delivered over to them only after the close of the war. Elkan and Frohnknecht, meanwhile, had taken steps to become American citi-

zens. This arrangement regarding Elkan and Frohnknecht's voting trust certificates was upset, however, when the Alien Property Custodian in Washington, after prolonged investigation, seized these certificates on the ground that Elkan and Frohnknecht had acquired them actually in behalf of Beer, Sondheimer & Co., of Frankfort. The Alien Property Custodian also seized 65,230 more voting trust certificates representing the interest of Beer, Sondheimer & Co. of Frankfort, through the latter's ownership of 32,615 shares in the (1913) American Syndicate, so that over 100,000 voting trust certificates have now been taken over by the Alien Property Custodian as having been German controlled.

How American Mining Interests Make "Atonement" and Are "Shriven"

The schedule of royalty rates put out by the Minerals Separation North American Corporation was introduced in evidence. It showed four methods for computing royalties: Percentage, unitage, tonnage, or a flat rate, and great stress was laid by Mr. Ballot upon the fact that the licensee was permitted to choose any of these methods that might suit him, though Dr. Gregory later testified that as a matter of fact all of these royalty rates worked out practically to the same result. "Out of every dollar's worth saved," Dr. Gregory testified, "we ought to get something in the neighborhood of, say, ten cents to satisfy our own end, and we framed our royalty to suit that. All those various schedules really amount to that."

Mr. Ballot estimated that there were 120 licensees under the Minerals Separation patents treating about 28,000,000 tons of ore annually, and about 500 infringers treating about 40,000,000 tons of ore annually. During the war, according to Mr. Ballot, Minerals Separation refrained from prosecuting any infringers in order to permit the greatest possible production of metal for America and her allies. Now, however, the Minerals Separation policy is to settle with infringers upon payment of double the usual royalties during the period of infringement and then to issue a license at regular rates. "If I am an infringer, and want to atone for my past misdeeds, and agree to pay double the amount of this schedule which may be collected, I am shriven for my past misdeeds, and have the right to take a license. And if I don't want to take a license, you (i.e. Minerals Separation North American Corporation) will shrive me for my past deeds, and let me go my way, whether I take a license or not," is the way counsel for Minerals Separation North American Corporation expressed it.

Although Minerals Separation North American Corporation, in its formal answer to the Federal Trade Commission's complaint, declared that only two exceptions had ever been made to its standard form of license agreement, Mr. Ballot admitted that at least eleven large companies were working under license agreements which differed from the standard form. Inquiry by the Federal Trade Commission's counsel also elicited the information that there were three other special license agreements and that a rebate of one-half the prescribed royalty had been made to another large company.

The financial condition of Minerals Separation North American Corporation proved to be very delicate ground, and inquiry concerning it by the Federal Trade Commission's counsel aroused strenuous opposition on the part of the corporation's counsel. Mr. Ballot was asked to tell the corporation's gross income, but after a heated argument was directed by his counsel not to answer, and he accordingly refused to do so. He likewise refused to state the book value of the corporation's stock or to answer any other question touching on income, dividends, surplus or profits, although demanded to answer by the examiner of the Federal Trade Commission conducting the investigation.

"Crooks," "Thieves" and "Unethical Means"

Dr. Gregory testified that he is a British subject, born in Persia and residing in the United States, and has been connected with the Minerals Separation companies since the start. He is resident managing director of the British companies, and is now vice-president of the North American Corporation. Dr. Gregory was anxious to explain the provisions of the Minerals Separation license agreement, which he declared had been unjustly criticised. "Our contract," Dr. Gregory testified, "is designed to prevent, if I may use the word, crooks from overreaching themselves, but with the honest man our contract has absolutely no fears." To the objection that their contract never terminated, Dr. Gregory replied that it "terminates upon their ceasing to use the flotation process, and it commences again when they start to use it." Referring to the clause of the Minerals Separation contract relating to the use of apparatus not covered by Minerals Separation patents, Dr. Gregory stated that "as a protection to ourselves we put in this clause, 'that when you are going to use our process you must use our apparatus.'" The clause regarding the acquisition of inventions made by Minerals Separation licensees was inserted, Dr. Gregory testified, because "we wanted to make ourselves a sort of exchange whereby all our clients would get the benefit of the inventions mutually, without any extra expense."

Dr. Gregory told of Mineral Separation's methods of getting evidence against Mr. Hyde and the Butte & Superior Co. "They had got their doors locked. They had it fortified in every way so as to make it impossible for us to get in. So we were compelled to trespass—absolute robbery. Our chief engineer, Mr. Nutter, went right into the place by force, and he took some of the stuff and put it into a bottle, and they nearly knocked his head off, and they followed him, and in the meantime he had posted the bottle under registered cover, and so on, to our patent lawyers. You have to set a thief to catch a thief, don't you know. That act of trespass did not in any way militate against us. We may have occasion to employ men who will use their ingenuity and skill to get into places and find out what people are doing. If I were to go and to ask them to let me in, they might ask me to walk out, or what not; so we have to use all the modern methods that everybody uses, as detectives."

Referring to these methods, Mr. Ballot testified: "It was an awkward thing to do and an unpleasant thing to do, but it was a necessity. That necessity required a man to handle it carefully." Accordingly, a mining engineer who had formerly acted as agent for Beer, Sondheimer & Co. was asked to "get the necessary information," and according to Mr. Ballot, upon his recommendation a "man was engaged at a regular salary and proceeded to Butte and there entered the service of the Butte & Superior company, and got the information, reported the information, which was sent to the New York office—I think most of the correspondence was afterward addressed to myself. The men who got the information were never put on the stand." Numerous letters between these spies and this former agent of Beer, Sondheimer & Co., and Mr. Ballot and other officers of Minerals Separation North American Corporation referring to the employment of these spies and their compensation by Minerals Separation and their reports of their observations at the plants of Butte & Superior company, Miami Copper Co., and elsewhere, including one letter, dated Jan. 10, 1918, upon the letterhead of the Salt Lake City representative of Beer, Sondheimer & Co., Inc., addressed to Mr. Ballot and informing him that the writer had "secured by devious and most unethical methods a sample of X-cake, which I am sending by registered mail to Mr. Higgins today," were put into the record by the Federal Trade Commission's counsel.

Attitude Toward Publications on Flotation

Dr. Gregory stated that Minerals Separation did not guarantee the validity of its patents, and referred to its "dangerous patent position." Under clause 6 of its license agreement, Minerals Separation, according to Dr. Gregory, reserves the right to edit publications by its licensees on the subject of flotation. "As long as it does not in any way hurt us, we are not concerned about it. Your opponents never hesitate to attack you from any quarter that it is possible to attack from. I mean, if you take out a patent, they immediately bind us to anything that is in that patent, by saying, 'Why, you yourselves called this a froth flotation. How can you say that that is not the same as the other?' They

have tried very hard to fix us to certain things in order to invalidate our patents by quotations from statements of our employees. Therefore, we consider it wise, especially when our patent position is in such a dangerous position, not to allow half-cooked and half-baked statements to come out, the responsibility of which ultimately rests upon us. That was one of the reasons why we came to the conclusion that, while it may seem that the outer world does not get half-baked ideas, we did not think it right that they should get to know things under conditions which they would use against us. It is self-protection. I would say that it was an absolute dereliction of duty on my part if I allowed any employee of ours to go and ruin the prospect of a company just because he wanted to air his views, which might be nothing or which might be something; and that is the reason that we introduced that in that contract. We have had requests, which we have more often refused, when we have discovered that it is not right; or where we have been able to satisfy ourselves that it would be innocuous, we have allowed it; but it has done us harm, nevertheless, although we thought that it was innocuous. We have to take our chances, to satisfy the vanity of some of our licensees. It does not mean money to them so much as it means the publication of their works, etc."

"This process" said Dr. Gregory, describing flotation, "is so jolly simple, you have only to take the stuff and put it in the box—I don't care what kind of a box you like to put it in, you know; you can put it into any sort of a box, and you can put a paddle into it, and shake it up, and it will come out; it is finished. It is so jolly simple, as I said before, that everybody thinks they can work this."

Neither Dr. Gregory nor Mr. Ballot would admit that there were any authoritative books on the subject of flotation. Dr. Gregory stated that he had not read Mr. Rickard's book, and Mr. Ballot testified: "Minerals Separation permitted T. J. Hoover to write a book, or compile a book. T. J. Hoover was general manager of Minerals Separation for a period of years. The manuscript of that book was submitted to Minerals Separation directors for approval. There were certain excisions made from it, because it was considered impolitic at that time, as against the company's commercial interest, to publish certain things, as the company was engaged in very active litigation. Some of these decisions he respected, and I think some of the matter was printed even without permission, without being finally passed." Mr. Ballot declared, however, that he had not read Mr. Hoover's book.

Mr. Frohnknecht testified that he came to the United States from Germany in 1906 with Mr. Elkan to take charge of the American branch of Beer, Sondheimer & Co., with which firm he had been connected in Frankfort for several years previous. Mr. Frohnknecht was a German subject, but took steps to become an American citizen in August, 1914, immediately after the Great War broke out. Speaking of the business transacted by Elkan and Frohnknecht as the New York branch of Beer, Sondheimer & Co., of Frankfort, ex-Secretary of War Lindley M. Garrison, counsel for Frohnknecht, stated that unquestionably it was entirely the business of the German firm.

Elkan and Frohnknecht handled the Minerals Separation agency for Beer, Sondheimer & Co. until Oct. 5, 1914, when they took it over for themselves, receiving 17,500 shares of the (1913) American Syndicate stock in lieu of commissions. Upon the organization of the North American Corporation each became entitled to 17,500 shares of stock, and the North American Corporation took over the entire management of Minerals Separation affairs in the United States.

In 1915, Beer, Sondheimer & Co., Inc., was organized, taking over all Elkan and Frohnknecht's business except Minerals Separation matters, and Elkan became president and Frohnknecht vice-president of the new company. The offices of Beer, Sondheimer & Co., Inc., adjoined those of Minerals Separation North American Corporation at 61 Broadway, New York. Although Minerals Separation North American Corporation rent a part of their space from Beer, Sondheimer & Co., Inc., and the president and vice-president of Beer, Sondheimer & Co., Inc., were general agents of the latter and each owned a large block of Minerals Separation North American Corporation voting trust certificates, until the Alien Property Custodian, in Washington, intervened and took over these certificates on the ground that they really belonged to Beer, Sondheimer & Co. of Frankfort, Germany, it was emphasized by the Minerals Separation representatives that Beer Sondheimer & Co., Inc., and Minerals Separation North American Corporation had no real working arrangement or understanding at the present time.

The hearings have been adjourned for a few weeks to permit Federal Trade Commission's counsel to study the evidence introduced and to examine further the books and records of the respondents.

Fifteen Shop Men Strike at Utah Copper's Arthur Plant

Fifteen machine-shop workers at the Arthur plant of the Utah Copper Co. went on strike April 17, giving as their reason that they were unwilling to work on castings characterized by them as "unfair," the meaning of "unfair" being that the castings, which as it happens were made in a local shop and by Utah men, were made by non-union labor. No exception has been taken as to wages or working conditions; and the point at issue is clearly one of open shop. There is evidence that the men, who are old employees, left work very unwillingly, and through outside compulsion.

Important Merger Effected at Leadville, Col.

Western Zinc Concentration Co. and Down Town Mines Co. Consolidated—Will Enlarge Plant Before August 1

The consummation of one of the most important mining deals in the Leadville district for several years has just been made known in the announcement of the merger of interests represented by the Down Town Mines Co. and the Western Zinc Concentrating Co., under the name of the Western Zinc Oxide Co. Ex-Governor Jesse McDonald, manager of the Down Town Mines Co., is manager of the newly organized company.

The Western Zinc Concentrating Co. has been successfully operating a small plant for smelting low-grade oxidized zinc ores, running 16 per cent zinc and over. In spite of the company's name, the plant has not been used as a concentrator for some time, but with the installation of furnaces, has been turning out a low-leaded zinc oxide which has been shipped to the B. F. Goodrich Company, of Akron, Ohio. It will be enlarged at once. Construction work is under way on a new furnace building, 120 x 44 ft.; a motor room 40 ft. square, and a bag house, 100 x 44 ft. Sixteen new furnaces will be added to the eighteen already in operation and will be of the latest Wetherill type, and equipped with certain improvements which the company has developed at the plant during the last year.

A pipe line 1,200 ft. long will connect the new block of furnaces with the bag house, which will contain ninety-six hoppers with a battery of four bags to the hopper. A heavy duty Jeffrey pulverizer will be installed in the mill with elevating machinery to automatic mixing bins of 200 tons' capacity. The packing plant will be two stories high, the oxide being elevated to bolting machines which will be installed to remove every particle of impurity from the product to prepare it for market.

When the new unit is completed, 34 furnaces will be in daily operation, making the capacity about 100 tons per day. The enlarged plant will be in full operation by August 1, it is expected. From 10 to 12 tons of zinc oxide will be produced daily.

Between 60,000 and 100,000 tons of these ores is partially blocked out in the property of the Down Town Mines Co., which is said to be sufficient to supply the plant for nearly ten years. Other mines of the company may also be called upon.

The Western Zinc Concentrating Co.'s plant when first erected was intended only for smelting low-grade zinc oxide ores. Improvements in equipment, however, now permit the treatment of any grade of zinc ore running over 16 per cent. The addition of the new unit will make it possible to treat 14 per cent ores, and probably 12 per cent ores in time.

Dolly Varden Act Stands

Dominion Government Refuses To Disallow British Columbia Legislation —Appeal to Provincial Court

The Minister of Justice, at Ottawa, has announced that there will be no disallowance of the Dolly Varden Act of the British Columbia Legislature under the terms of which the Taylor Mining Co. acquired possession of the Dolly Varden mine at Alice Arm, B. C., together with certain mining equipment, and a line of railway from tidewater to the property, the latter at the time of the change of ownership being within a short distance of completion. Immediately this information was received, R. T. Elliott, K.C., legal representative of the original Dolly Varden Mines Co., took the necessary steps to have the validity of the provincial legislation and the title of the Taylor Mining Co. to the property tested in the British Columbia courts. Mr. Elliott has issued two writs, one asking for a series of declarations setting aside the act and all proceedings taken under its provisions and the other asking for damages for alleged trespass and for payment to the plaintiff of all money realized from ores produced at the mine.

Ward-Hopp Litigation Over Bullion Mine in Final Stage

Ward Won Decision, but May Be Ousted as Trustee—Application for His Dismissal Pending

The Ward-Hopp litigation, a struggle for possession of the Bullion mine property which was carried through all Canadian courts and even to the Privy Council of the empire, is nearing its finish. R. T. Ward and his associates have been declared the winners of this long-drawn-out legal battle and now there is before the Provincial Legislature a special bill, entitled the "Cariboo Hydraulic Mining Co. Amendment Act, 1920," which renews and extends for a period of thirty years the placer leases of the company. Mr. Ward, however, evidently has not seen the last of his legal troubles, for, as soon as the Legislative Assembly re-establishes the company's title to the property, he must defend himself in court against an application made by a group of his associates for his dismissal from the position of trustee of the Bullion mine and for a declaration by the judge of the respective interests of Messrs. Ward *et al.* in the property.

Thomas W. Lawson Guilty—Fined $1,000

Thomas W. Lawson and L. C. Van Riper, brokers, were fined $1,000 each in the Municipal Court in Boston on April 21 for violation of the state statute concerning the advertisement of mining stocks. Lawson and Van Riper, together with several curb brokers, were arrested recently in the campaign of Attorney General Allen against illegal advertising of stocks.

Lawson pleaded guilty to the complaint, which contained thirteen counts. He was fined $100 on each of ten counts and three were placed on file. The complaint against Van Riper contained ten counts, to which he pleaded guilty, and he was also fined $100 on each count. Attorney General Allen urged a jail sentence, or the maximum fine of $2,500 for Lawson. Several others who had pleaded guilty or had been convicted were likewise fined by the court.

Great Lakes Navigation Opened on April 23

Navigation from the head of the Lakes opened on April 23 with the departure of the steamer "Harvester," loaded with ore, from Superior for South Chicago. The "Harvester" locked through the Soo canal on April 19 and arrived in Superior two days later, reporting large but not impassable ice fields off Whitefish Point. The "Barlum" locked through with the "Harvester" and went to Ashland for a load of ore. She was diverted to Superior for a cargo of grain for Lake Erie ports.

Practically all shaft mines on the Mesabi, Vermilion and Cuyuna ranges are now shipping to the docks, which are accumulating ore against the arrival of the main fleet. Very few of the open pits have started shipments, because of the unsettled railroad conditions prevailing about the lower Lakes. The Duluth, Missabe & Northern is receiving ore, but is holding it in upper yards pending the season's agreement with the unions.

The Great Northern is accepting ore for Lake shipment. It has changed its method of handling ore shipments by contracting for the work of unloading the ore and loading the boats. It is reported that the contract is let on a basis of 4c. per ton from car to vessel hold.

Black Lake Asbestos & Chrome Co. Loses Damage Suit

Judgment was given April 21 by Judge Kelly in an action for damages brought by Frank Samuel, of Philadelphia, against the Black Lake Asbestos & Chrome Co., of Toronto, for failure to carry out contracts for the sale of 3,500 gross tons of chrome ore. The contracts were made in April, 1917. Instead of delivering 3,500 tons, the Black Lake company delivered only 815 tons and then refused to make further deliveries. At the trial the defence put forward was that the ore had "pinched out" and also that the Imperial Munitions Board directed the company to sell to Canadian companies for munition work instead of exporting. Judge Kelly held that neither of these was the reason for non-delivery and found that there had been no interference by the Munitions Board with production or export. He awarded the plaintiff damages to the amount of $80,491 and costs.

Metals Extraction Corporation Will Erect Other Plants

Joplin Company To Make Leaded Oxides as Well as Chemically Pure Product

The new zinc oxide plant of the Metals Extraction Corporation of Joplin, Mo., is expected to be in operation within a few days and will begin with a production of 10,000 lb. per day, which will be increased to about 80,000 lb. of lead-free zinc oxide per day by July or August. Zinc oxide will be made by a new process, invented by A. Schwarz, consisting of a direct burning of sulphide into oxide, the furnace campaign requiring only thirty minutes, as stated in previous issues of *Engineering and Mining Journal.*

The first plant which has been erected in Joplin will produce only lead-free zinc oxide. Erection of several other plants is being considered which will produce leaded oxides as well as C.P. or medicinal oxide. The office of the president of the Metals Extraction Corporation is 212 McKinley, Joplin. Donald M. Liddell, of New York, is consulting engineer.

Recent Production Reports

Granby Consolidated produced 2,095,500 lb. copper in March against 2,180,000 in February.

Rand mines produced 707.036 oz. gold in March against 625,339 oz. in February.

Chile Copper Co., produced 9,256,000 lb. copper in March against 8,630,000 in February.

Burma Corporation, Namtu, Burma, in March produced 6,415,360 lb. lead from 7,475 tons of lead-bearing material; 4,885,440 lb. refined lead and approximately 261,580 oz. refined silver.

East Butte produced 1,909,720 lb. copper in March compared with 1,460,360 in February.

The March output of Michigan copper mines is given as follows:

Mine	Rock Tonnage	Refined March	Refined Feb.
Ahmeek	68,000	2,031,800	1,484,200
Allouez	20,500	428,400	284,639
Baltic	16,000	544,000	476,000
Calumet and Hecla	207,333	5,183,325	4,951,313
Centennial	7,000	97,284	65,000
Champion	30,000	1,200,000	1,330,000
Isle Royale	63,523	1,079,900	927,600
Michigan	5,600	123,200	134,160
Mohawk	40,291	1,041,874	1,056,564
Osceola Cons	50,000	773,800	787,300
Quincy	80,000	1,440,000	1,620,000
Trimountain	14,000	420,000	348,000
Victoria	5,825	99,025	114,000
Wolverine	10,710	267,793	236,439
Winona	7,000	105,000	118,300
White Pine	14,293	285,870	250,000

With a view to stabilizing working forces, a number of mines at Park City, Utah, seeking to overcome difficulties attendant upon a shortage of good miners, have adopted the bonus system of shift allowances to their men. The Silver King Coalition, the Ontario, and the Daly mines, beginning April 15, are allowing two extra shifts to all employees putting in twenty-eight continuous shifts a month. The Judge Mining & Smelting Co. has had a similar system in operation for some time.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Small Hope for War-Minerals Bill at Present Session

Leaders Opposed—Measure Introduced in Senate, but Lacking Changes Made in House Bill

Even with the changes agreed upon by the Committee on Mines and Mining, Representative Mondell, the majority leader of the House, is still unwilling to have consideration given to the new War-Minerals Relief bill. Until the leaders can be won over, there is little probability of securing such consideration. The measure must come before the House by a special rule if it is to be given attention in the near future. Every effort is being made to dispose of the more urgent legislation so that Congress can take a recess during the summer. As a result, a legislative jam is in prospect, thereby reducing materially any chance of securing the proposed changes in War-Minerals Relief procedure.

Fearing that action may not be secured in the House, friends of the measure have had it introduced in the Senate. It is significant that the bill, just introduced in the Senate, does not embody the recent changes agreed upon in the House committee. It provides for the consideration "de novo," and is in every way identical with the bill introduced in the House by Representative Garland.

Opposition to Anti-Dumping Bill Looked For

Vigorous opposition may be expected to the Fordney Anti-Dumping Bill. This much may be gathered from the report of the minority members of the Finance Committee of the Senate, which recently reported the bill favorably. In the course of the report, which was written by Senator Thomas, of Colorado, the following statements were made:

"The bill is based upon the assumption that goods of foreign manufacture have been assembled in great quantities during the war, due largely to its dislocation of outside markets, which are to be imported to America and sold here at prices below the cost of domestic manufacture and distribution, thus arresting domestic production and threatening the prosperity of domestic manufacturers.

"If there be such a menace, its visitation would not in these days of exorbitant prices and expensive living be an unmixed evil. Indeed, most people would welcome such a blessed relief from the exactions of the home market, for it might enable most of them to limit their necessary expenses to their incomes. We would be inclined to welcome the experiment, for we are convinced that it would prove much more of a blessing than a curse.

"But no such condition confronts us of which we are aware. We have listened to many assertions of its existence, but have been favored with little positive evidence to support them. Every manufacturer and many merchants believe that with the reaction of peace there will come a reaction of prices through a flood of imports. Belief stimulated by self-interest easily ripens into conviction, and that in turn appeals to Congress for preventive legislation. This, and this alone, in my opinion, is the moving force behind this bill."

Claim Holders Seek Exemption From 1920 Assessment Work

Requests in large numbers are reaching the Committees on Mines and Mining of the Senate and of the House that prompt steps be taken to make assessment work unnecessary in 1920. It is pointed out that the labor situation is such that it would be an economic crime to require assessment work this year. It is also pointed out that much uncertainty would be avoided if this legislation is not left until the end of the year. Attention is called to the fact that there might be opposition to the proposal and in case of failure to grant suspension during this year, the entire work would have to be done during the closing weeks of the year, which would militate against all industries in mining regions. In addition, those who hold claims in regions where the winter is severe would like to know definitely at the earliest possible date what is going to be done, so that assessment work can be done in the summer months.

Cameron Claims Near Grand Canyon Held Invalid

No Mineral Discovery—U. S. Supreme Court Upholds Secretary of Interior and Lower Courts

By holding that the mineral claims of Ralph H. Cameron and others, near the Grand Canyon, Ariz., are not mineral and that there has been no discovery and that the location was invalid, the U. S. Supreme Court has disposed of extended litigation. The Supreme Court upholds the Secretary of the Interior and the courts below.

The case was brought by the United States to enjoin Cameron and others from occupying and using for business purposes a property on the southern rim of the Grand Canyon of Colorado which was being held as a lode-mining claim. The claim embraces the head of the trail which visitors use to descend and ascend from the bottom of the canyon. The principal use of the claim was in the conduct of a livery establishment. The decision is of particular interest because of the discussion in the opinion of what constitutes an adequate mineral discovery and the conditions under which a patent may be denied. In the course of its opinion, the court makes the following statement:

"After and notwithstanding these decisions Cameron asserted an exclusive right to the possession and enjoyment of the tract, as if the lode claim were valid; and he and his co-defendants who were acting for or under him, continued to occupy and use the ground for livery and other business purposes, and in that and other ways obstructed its use by the public as a part of the reserves. In this situation, and to put

STATUS OF PENDING MINING LEGISLATION

Bills That Have Reached Committee Stage

Subject of Bill	*Bill No.*	*Author*	*Present Status*
Silver in coins	*H.R.* 11,226	*McFadden*	*Before House Committee*
Met. Min. on Ind. Res.	*S.* 287	*Ashurst*	*On Senate Calendar*
Timber for mining purposes	*S. No.* 1	*Pittman*	*Passed Senate Oct.* 3, *before House Committee*
Anti-dumping	*H.R.* 10,918	*Fordney*	*Passed House Dec.* 9, *on Senate Calendar*
Laboratory glassware	*H.R.* 7,785	*Bacharach*	*Passed House Aug.* 2, *on Senate Calendar*
Magnesite	*H.R.* 5,218	*Hadley*	*Passed House Aug.* 7, *on Senate Calendar*
Tungsten	*H.R.* 4,437	*Timberlake*	*Passed House Aug.* 21, *on Senate Calendar*
Zinc	*H.R.* 6,238	*McPherson*	*Passed House Sept.* 2, *on Senate Calendar*
War Minerals Relief	*H. R.* 13,091	*Garland*	*Reported favorably to the House March* 25.

an end to what the Government deemed a continuing trespass, purpresture and public nuisance, the present suit was brought.

"The courts below ruled that the decisions of the Secretary of the Interior should be taken as conclusively determining the non-mineral character of the land and the absence of an adequate mineral discovery, and also as showing that the matter before the Secretary was not merely the application for a patent but also the status of the claim—whether it was valid or was wanting in essential elements of validity, and whether it entitled Cameron to the use of the land as against the public and the Government. As before stated, the defendants complain of that ruling. The objections urged against it are, first, that the Secretary's decisions show that he proceeded upon a misconception of what under the law constitutes an adequate mineral discovery, and, second, that although the Secretary had ample authority to determine whether Cameron was entitled to a patent, he was without authority to determine the character of the land or the question of discovery, or to pronounce the claim invalid.

"As to the first objection little need be said. A reading of each decision in its entirety, and not merely the excerpts to which the defendants invite attention, makes it plain that the Secretary proceeded upon the theory that to support a mining location the discovery should be such as would justify a person of ordinary prudence in the further expenditure of his time and means in an effort to develop a paying mine. That is not a novel or mistaken test, but is one which the Land Department long has applied and this court has approved. Chrisman v. Miller, 197 U. S. 313, 322.

"The second objection rests on the naked proposition that the Secretary was without power to determine whether the asserted lode claim, under which Cameron was occupying and using a part of the reserves to the exclusion of the public and the reserve officers, was a valid claim. We say 'naked proposition' because it is not objected that Cameron did not have a full and fair hearing, or that any fraud was practised against him, but only that the Secretary was without any power of decision in the matter. In our opinion the proposition is not tenable.

"The argument is advanced that the department necessarily is without authority to pronounce a mining location invalid, because it has within itself no means of executing its decision, such as dispossessing the locator. But this is not a proper test of the existence of the authority, for the department is without the means of executing most of its decisions in the sense suggested. When it issues a patent it has no means of putting the grantee in possession, and yet its authority to issue patents is beyond question. When it awards a tract to one of two rival homestead claimants it has no means of putting the successful one in possession or the other one out, and yet its authority to determine which has the better claim is settled by repeated decisions of this court. And a similar situation exists in respect of most of the claims or controversies on which the department must pass in regular course. Its province is that of determining questions of fact and right under the public land laws, of recognizing or disapproving claims according to their merits and of granting or refusing patents as the law may give sanction for the one or the other. When there is occasion to enforce its decisions in the sense suggested, this is done through suits instituted by the successful claimants or by the Government, as the one or the other may have the requisite interest.

"Whether the tract covered by Cameron's location was mineral and whether there had been the requisite discovery were questions of fact, the decision of which by the Secretary of the Interior was conclusive in the absence of fraud or imposition, and none was claimed."

NEWS BY MINING DISTRICTS

ARIZONA

Shattuck Arizona Deepening Shaft 200 Ft.—Denn-Arizona Strikes Good Ore on 1,700 Level

Bisbee—Shattuck Arizona is obtaining a small output of sulphide ores from the territory flooded at the time of the mine fire. An increased output of these ores is expected shortly. The mud and debris has been cleaned out of the shaft and sinking of the proposed additional 200 ft. began on March 29. This work is being done necessarily on night shift as the shaft is too busy during the day when both lead and copper ores are being hoisted. When sinking has progressed 20 ft. below the present level bulkheads will be installed and sinking carried on on three shifts.

Copper ore produced is coming chiefly from above the 500 level. The high-grade on the 100-ft. level is opening up well. On the south it is copper glance running well in silver. On the north it consists of mixed copper and lead ores running 6 per cent copper, 7 per cent lead and 60 oz. silver. This has been developed for about 160 ft.

In the 27 days ended March 31 about 10,000 tons of low-grade lead ores was shipped to the mill and 2,500 tons copper ore to the smelter. An effort was made to produce as much lead ore as possible on account of the high price of lead. The mine is running on one shift only, owing to labor shortage. On April 16, 162 men were employed underground.

Denn—Arizona has made an important development in ore on the 1,700 level in 19 crosscut. The new ore is a rich oxide and carbonate mixture, running about 14 per cent copper. It appears now that this ore is connected with the rich sulphide ores found at and near 34 raise. This indicates that the width of the 1,700 level orebody is 105 ft. Important development in rich ores is looked for from development under this country on the 1,800-ft. level.

On the 1,800-ft. level the south side of the station is finished and a drift south is being rushed under the 1,700 orebody at the rate of a little more than 7 ft. per 24 hours. Progress in this drift may be delayed by the necessity of installing water doors, by means of which it is hoped to prevent the flooding of the 1,800-ft. level when the big flow of water expected on this level is encountered. Above the 1,600-ft. level the company continues to find scattered bunches of rich carbonate ores, west of the previously known orebody. On this level approximately 850 gal. per min. was handled throughout the month. Installation of the new compressor is near completion.

During the 27 days ended March 31 approximately 2,000 tons of copper ore was shipped. A small tonnage of this ore was produced in two prospects above the 1,400-ft. level. The main part of the present ore production is coming from the 1,600 and 1,700-ft. levels.

Prescott—The newly organized Peak Silver Mining Co. has effected a consolidation of the old Emporia, Black Horse, Benedict, Yellow Jacket, Lluvia de Oro, Happy Home, Bornite and Lost Burro properties, which are in various stages of development. H. H. Keays is president. Holdings are on the Hassayampa River, about 10 miles south of Prescott, and include 62 claims or about 1,230 acres. Unwatering of the 130-ft. Black Horse shaft is in progress.

The best developed property in the holdings is the old Emporia which produced for a number of years until just prior to the war. Two shafts each 200 ft. deep and considerable lateral work constitute the development. It is estimated that 9,500 tons of milling ore is available immediately. The new company plans to install flotation equipment in the Emporia mill. The formation is quartz-diorite and the main ore body a fissure 4 to 16 ft. wide. Assets include 4,000,000 ft. of virgin pine timber, 2,000-hp. water power and several camps.

IDAHO

Tamarack & Custer To Connect Mine and Mill With Tunnel from Canyon Creek—Nabob Mill To Recover Zinc

Wallace—At the annual meeting of stockholders of the Hecla Mining Co. on April 13 the vacancy caused by the death of Frank Upman, director, of Los Angeles, was filled by the election of E. J. Nolan, of Los Angeles, attorney for the Upman estate. With this exception the officers and directors were re-elected. Regarding the important development work in progress on the 2,000 level, J. F. McCarthy, president, stated: "The ore is developing finely on the 2,000-ft. level. The vein is 15 to 16 ft. wide and well filled with ore. The ore has been followed 400 ft. by drift since it was encountered several months ago."

The Chicago-Boston was forced to discontinue after sinking 60 ft. from the 200 level, on account of inability to secure shaft men. It was purposed to sink to 400 ft. before crosscutting. Work is now being pushed on the 200 level, where promising ore has been found.

The Nabob Consolidated has arranged to spend $45,000 in adding facilities to the mill for recovering the zinc, and to provide electric haulage in the long tunnel. The Nabob ore is a combination of lead-silver and zinc, only the former being recovered at present. The mill has a capacity of 150 tons.

The Yankee Boy, on Big Creek, is sinking on the vein from the lower tunnel which shows a foot of lead-silver and gray-copper ore. This property has for many years been a shipper of high-grade silver ore in the form of gray copper, mined chiefly by lessees on the several tunnel levels. Lead-silver ore has made its appearance in the lowest tunnel. The company plans extensive exploration work through the shaft.

The Tamarack & Custer is preparing to drive a tunnel, one and a half miles long, from Canyon Creek which will tap the orebody several hundred feet below the present workings and provide a direct underground connection between the mine and mill. This enterprise has long been planned, and it was expected when the Green Hill-Cleveland was abandoned by the Federal Mining & Smelting Co. that the Tamarack & Custer would secure rights by which it would obtain the desired outlet by crosscutting from the old Green Hill-Cleveland workings, a distance of probably not more than 1,500 ft. This would enable the company to deliver its ore through No. 6 tunnel, the portal of which is only a short distance above the mill on Canyon Creek. However, Tamarack & Custer engineers have recently been engaged in locating a tunnel site and line of tunnel at a point a short distance below No. 6. The company now has an aerial tramway connecting the mine and mill, about two miles long, which it is understood has never given the maximum service.

COLORADO

Hesperus—The Jumbo Mining Co., operating the Jumbo mine, near Mayday, is shipping a car of ore weekly from the lime stratum that has been very productive in the past. Shipments began last July since when several orebodies have been uncovered.

Ouray—Examining engineers and mine investors should be advised that owing to the unusually heavy late snows, examinations and new mining work in this district cannot be attempted for several weeks. Normally, such work should begin about this time but continual snows, part of the general storms, have covered the country deeply and the spring melting has not begun. Several examinations already contracted for are being held up, while the new operations of the Eurades company, the Wyoming lessees, the Silver Link and the Red Mountain mines have not yet been attempted.

Camp Bird recently laid off twenty-five men; work continues with a very much smaller force than previously but no public information is given out.

Attempts to secure tax titles to mining property are becoming numerous. Recently, the representative of an outside investment company paid up $17,000 in back taxes on only four mines—Wanakah or Bright Diamond, Ouray S. & R. Co. (which is the local smelter, now idle) the Gold Crown, and the Revenue Tunnel. No doubt all will be redeemed but this move shows active belief in the district, as in all cases prompt action was taken by the buyer to force issuance of tax titles unless redeemed.

E. R. Baur, operating the Hidden Treasure near the Camp Bird, has started opening a sled road to the mine to haul out an accumulation of silver-lead shipping ore and is now out of town arranging for funds to place a milling plant on the property. The mine shows a large tonnage of good grade lead-zinc ore carrying silver.

MICHIGAN

Calumet—Seneca has started drifts in two directions on the 3rd and 4th levels. The crosscuts went through the Kearsarge amygdaloid formation showing rich material on the former level and fairly good vein matter on the 4th. Shipments of "rock" have been resumed to the Baltic mill.

At the Gratiot property the drift on the 13th level, to the south, is now in 30 ft. and is showing some copper. The formation is peculiar and unlike the Kearsarge amygdaloid, there being little shot copper, most of the material being of the mortar-discharge size that comes out in the heads at the stamp mill or small mass copper. Other work on the Gratiot will be pushed when additional men may be secured.

The program of diamond drilling from the surface, undertaken about January 1, has been completed. There is no evidence to warrant further development of any of the Seneca lodes except the Kearsarge amygdaloid.

MINNESOTA

Cuyuna Range

Ironton.—The Mahnomen pit of C. K. Quinn & Co. is working one shovel and removing about 65,000 yards of stripping. It expects to lead in Cuyuna Range shipments as in the past.

Crosby—Coates & Tweed are reported to have sold 250,000 tons of manganiferous ore from the Gordon pit. One shovel is stripping.

At the Croft, a shovel has been moved into the stockpile and will begin loading as soon as navigation starts. The company has been loading from the pocket since March 28.

The Ida Mae has been developing through the winter and has a stockpile of 18,000 tons of good grade of manganiferous ore. It closed down April 15, pending a better market.

Cuyuna—At the Northland, an underground manganiferous property, pumping is being done, awaiting market developments. One drill is operating.

Riverton—At the Rowe, removal of ore in the bottom of the pit will be completed by means of the milling system. The shaft will be deepened 150 ft.

Ironton—The Cuyuna-Duluth is shipping ore from the pocket.

The Sagamore will ship about 250,000 tons of manganiferous ore from its pit. Loading will be done by the Winston-Dear company again this season. A screening and drying plant will be erected but will not be in operation this year. Drying tubes are being fabricated.

Trommald—The Maroco property, leased from the Adbar Development Co. by the Marquette Ore Co., will be stripped hydraulically as soon as frost will allow. An inclined drainage shaft is being sunk which is not yet ledged.

Duluth—The village of Spina, Minn., has begun suit against the Dean Iron Co., in the district court in Duluth, to recover $1,865 which the village claims to have spent in maintaining streets, culverts and bridges injured by the sluff from the stripping dump of the company's Dean mine. The company has had to stand several other suits on the same count, one in particular being that of a saloon proprietor claiming damage to a stock of liquor caused by a landslide from the dump which occurred in the days when liquor was still recognized by the law as valuable personal property.

OKLAHOMA

Picher—The Lone Star has started sinking a new shaft on its lease near that on the Aztec and Mogul properties, two miles east of Picher. The first shaft put down a year or more ago failed to prove satisfactory. The new shaft is the result of drilling.

The Commerce Mining & Royalty Co. is preparing to build a mill on its Wills-Day shaft, about two miles east of Picher. Development work since sinking was completed has had satisfactory results.

NEVADA

Rochester Combined Sued—Strike Tied Up Shipments for Dayton Dredge

Dayton—Six carloads of material for the big dredge which Bulkeley Wells and associates are building to work the placer ground near Dayton were tied up on the road by the railroad strike. A large quantity has already been delivered and four carloads, in addition to the six tied up, are yet to come. The dredge will be 110 x 45 ft.; the estimated capacity is 5,000 yd. per day. The buckets hold 9½ cu.ft. of gravel.

Rochester—Suit has been begun in the district court in Pershing County against the Rochester Combined Mines Co. for the recovery of $200,000, which is secured by notes and deed of trust. The deed of trust covers 69 mining claims and a 300-ton mill in the Rochester district.

Yerington—The Walker River Copper Co. has discontinued churn drilling for the present on its property in the Yerington district. It will remodel the mill and is preparing to resume mining.

Copper Canyon—The U. S. Supreme Court, on April 19, denied a petition for rehearing in the case of George Cole *et al.* against Joseph Ralph, involving title to placer claims at Copper Canyon, near Battle Mountain. A writ of mandate authorizing the plaintiffs to take possession of the property will be issued forthwith. It is said that Eastern interests are negotiating for the claims and will operate them on a big scale.

Tonopah—The Tonopah Mining Co. shipped $77,000 in bullion in March. This is the first shipped from the Millers plant for about two years, the ore having been milled at the Belmont company's plant in Tonopah during this time.

The West End mill is operating almost entirely on mine ore, custom tonnage being negligible. The West End company, operating under agreement with the Tonopah "76," is prospecting the latter company's ground on the 800 level from the Ohio shaft. The formation is favorable.

The Halifax Tonopah Mining Co., controlled by the West End, operating under agreement with the Mizpah Extension company, has cut a vein on the 1,100 level, from which regular shipments of good ore are being made. The importance of this discovery has yet to be proven by development, which is necessarily slow on account of difficult working conditions.

Divide—The report to stockholders of the Tonopah Divide should be out the coming week.

The Victory Divide reports discovery of high-grade ore but the developments to date are too meagre to estimate the importance of the find.

Tonopah Dividend will sink its main shaft to the 800-ft. level and crosscut to the ledge from this point. It is expected that the ledge will be reached within 100 ft.

NORTH CAROLINA

Candor—The Carolina Minerals Co. is operating the Iola gold mine near Candor. F. Washburn is in charge. A plant consisting of two log washers has been erected and is handling tailings from former operations. The waste dump from No. 2 Iola shaft is also available. It is said that a five-stamp mill will also be built to handle dump ores. The mine shut down in 1915 and the 50-ton cyanide mill and other equipment were moved elsewhere.

Hemp—In Moore County, El Oro Mining Co. has resumed work at its mine, which had been closed for over a year. The present mill, using ball mills, amalgamation, and concentration, will be used as a pilot mill.

Ashboro—A. J. Overton is building a 30-stamp amalgamating plant in Randolph County, 12 miles northeast of Ashboro.

Eldorado—The Coggins mine, near Eldorado, in Montgomery County, is running without interruption. The inclined shaft is now below 500 ft.

TENNESSEE

Ducktown—Over 60 ft. of sulphide ore has been crosscut on the 12th level of the Burra Burra mine of the Tennessee Copper Co. This is the lowest working in the Burra Burra shaft. MacPherson shaft is down to the 14th level.

TEXAS

Sweetwater — The United States Gypsum Co., of Chicago, has purchased 200 acres of land situated two miles east of Sweetwater, Tex., in Nolan County, and a corps of engineers under the direction of H. E. Brookby, development engineer of the company, is surveying the tract with a view to development. The tract is underlaid with deposits of gypsum, which will be used in the manufacture of cement.

UTAH

Ophir — Interesting developments may be expected at the old camp of Ophir, particularly on the south side of of Ophir Cañon. This camp has had a heavy producer and dividend payer for many years in the Ophir Hill Consolidated on the north side of the cañon. Recent work by geologists in this section shows that the ore-bearing limestone productive on the north side of the cañon has dropped about 600 ft. through faulting on the south or Lion Hill side of the cañon. The old Lion Hill workings reaching a depth of 300 ft. in the past produced a considerable tonnage of silver-lead ore. This property and adjoining ground has been taken over by a newly organized company, the Ophir Metals, backed by Eastern men, and systematic development is being carried on.

A road one and a quarter miles long has been built up the cañon from Ophir through rock at times requiring considerable blasting; buildings have been erected, and equipment installed. A tunnel is being driven to cut the ore-bearing limestone above mentioned, which is known as the Buckhorn limestone. Connections have been completed so that this work can be done more rapidly by electric power. The tunnel is in 548 ft., and at 800 ft. is expected to cut the Buckhorn limestone. At 1,200 ft., it will be directly beneath the old Lion Hill workings. The Ophir Central, also on the south side of Ophir Cañon, is prospecting its ground by means of diamond drilling.

Park City—An extra shift has been put on at the Three Kings. A winze is being sunk in mineralized ground and there is ore in three places.

The American Flag mine is reported to have been taken under bond and lease by one of the large smelting companies. Diamond drilling is being done from the 1,100-ft. level. The property, which comprises 22 claims covering about 300 acres, has a record of production of about $500,000.

Eureka—The Iron King, which began daily shipment on April 1 of a car of fluxing iron ore over the recently completed Goshen Valley Railroad, has been forced to stop shipping for a time owing to the car shortage.

The Chief Consolidated, shipping over the Salt Lake route entirely, has suffered particularly from the car shortage. The Tintic Milling, closed down for a short time to install a sluicing system, has been taking about 40 cars of low-grade siliceous ores weekly from a number of mines. This company will again be operating its milling plant in a few days.

The May Day is to levy an assessment of 2c. a share to provide funds for the work which it is carrying on at depth through the Yankee shaft.

Lark—At the Ohio Copper the new pump has not yet been operated owing to the breaking down of power connections during a severe snowstorm. These are being repaired and more rapid work will soon be possible.

VIRGINIA

Crimora—The Crimora Manganese Corporation resumed operations on April 1 after ten months' shut down. Before the washing plant will be put in commission, about 100,000 cu.yd. of overburden will be removed by stripping, which will take about two months. A. M. Yonge is general manager.

WASHINGTON

Chewelah—The Washington Water Power Co. will soon begin construction of a high-tension power line from its Long Lake plant to furnish power to various mining companies in the district. The Meyers Falls power plant has been unable to meet fully the heavy demands made upon it, particularly by the Northwestern Magnesite Co. and the United Silver-Copper Mining Co.

Bossburg—The Minorca - Homestake Mines Co. has been organized to take over and operate a group of claims in the Fifteen-Mile district about ten miles northwest of Bossburg. Samuel Glasgow, of Spokane, is president, and Victor P. Adams manager.

CANADA

British Columbia

Trail—Shipments to the Consolidated M. & S. Co.'s smelter during the week ended April 14 were as follows:

Mine	Location	Gross Tons
Iron Mask	Kamloops	48
Josie	Rossland	162
Last Chance	Sandon	27
North Star	Kimberley	67
Paradise	Athalmer	56
St. Eugene	Moyie	45
Silver Standard	New Hazleton	34
Sullivan (Zinc)	Kimberley	3,793
Sullivan (Lead)	Kimberley	176
Total		4,408

Princeton—The Horn Silver Mining Co., in the Similkameen district, is operating again after a period of idleness, weekly shipments of from 45 to 50 tons being sent to the Tacoma smelter.

Grand Forks—It has been officially announced that the Granby Consolidated M. S. & R. Co. will dismantle its mine plant at Phoenix, where the mines have been idle for some months. Those parts that can be used either at the company's Cassidy collieries on Vancouver Island, or at the copper smelter at Anyox, will be shipped to those places.

Rossland—The surface equipment of the White Bear mine was destroyed by fire recently. The transformer house was saved by packing snow about it.

Duncan—An aerial tramway, 4,750 ft. long, has been practically completed at the B. C. Manganese Co.'s Hill 60 mine, 13 miles from Duncan, B. C., on Vancouver Island. It will deliver ore from the mouth of the tunnel to the E. & N. railroad. Hill 60 ore, as shipped, has run 50 per cent Mn, 19 SiO_2, 0.90 Fe, 0.048 P, 0.10 S, 0.60 CaO, and 0.85 Al_2O_3. Lack of sufficient development forbids a tonnage estimate. Shipments have been made to the Bilrowe Alloys Co., of Tacoma, Wash. C. H. Dickie, of Duncan, is endeavoring to put the property on a substantial shipping basis.

Ontario

Toronto—At the annual meeting of the Associated Goldfields held in Toronto recently it was decided to renew the stock pool which was to have lapsed on July 1, until 30 days after the mill is in operation, or not later than Jan. 31, 1921. It was anticipated that when the pool broke more light might be thrown on the affairs of this company, which in the interests of the public it is desirable should happen. The officials claim large bodies of ore averaging $11.65. These figures are based on diamond drill results, and good engineers in this country do not estimate tonnage and values on diamond drill cores. A former manager of the property has stated that the best he could hope for was certain areas running between four and five dollars.

Considerable opposition has developed among prospectors and others to the proposed amendment to the mining act, whereby the fee for recording claims staked on licenses, other than those of the staker, will be raised from $10 to $15 a claim. It is pointed out that a large number of the most important mines of the district have been discovered by prospectors who were grubstaked by others. In the proposed amendments special consideration has been given to returned soldiers. The prospector is also to be given two free assays from each claim.

Cobalt—The central council of the mine employees of the Cobalt district is meeting with the mine managers to try to formulate a scheme of sickness insurance. The Miners' Union paid sickness and death benefits and the men claim that, although the Workmen's Compensation takes care of the time lost through accidents, since the union went to pieces they have no means of getting sick benefits. The men are willing to pay half the cost and ask the companies to pay the balance, which seems a fair enough proposal and one that meets with the approval of the mine managers. The men also ask that the fund be handled locally, under the jurisdiction of a committee composed of mine managers and workmen in order to give it a local flavor and to save the insurance companies' costs. Unfortunately, however, they seem to have very little knowledge of the cost of carrying insurance and they propose that for a total contribution of $1.50 a month, sick benefits to the extent of $2.75 a day should be paid. This is much larger than any insurance company would pay. The mine managers want to start it off on an actuarial basis and then if a sufficient surplus is created the rates can be lowered or the benefits increased.

The freight embargo has interfered to some extent with the shipment of ore from Cobalt to the United States, but in addition to this the big producers of silver bullion in the camp are not selling their product at present prices for the metal. It is estimated that at least 1,500,000 oz. is being held for higher prices.

The Kerr Lake is considering the treatment of old dumps, aggregating about 75,000 tons. They are to be carefully sampled to determine their value, and if the silver content is sufficiently high, the company will endeavor to have them treated.

The Kerr Lake has also acquired a gold dredging property in New Zealand. The area drilled is estimated to give a net profit of $3,436,000, and the annual return to the Kerr Lake should be $217,000, or approximately 50c. per share. During January and February of this year, the Kerr Lake mine, at Cobalt, produced 213,234 oz. of silver.

An interim report of the Kerr Lake mines has been issued, which shows that the company has been extending its operations. It has acquired the controlling interest in a silver mine in Utah, which started producing in December, 1919. There is a 150-ton mill on this property and ore reserves are estimated at 87,000 tons, averaging 18 oz. in silver, and 80c. in gold. Valuing silver at $1.10 per oz., it is estimated that the Utah mine will bring a profit of $9.50 per ton, and after repaying advances made on account of purchase price, out of earnings, the annual profit accruing to the Kerr Lake should be $265,000, or equivalent to 45c. per share on its issued capital. Only a small part of the Utah property has been prospected.

Gowganda—The Northern Light Railways Co. has been granted a charter for the construction of a light narrow-gage railway from Elk Lake to Gowganda and is prepared to proceed with the work at once. Having failed to induce the government to build a railway of standard gage, the leading operators are disposed to support the light-railway project, as shipping facilities have long been badly needed.

Quebec

Asbestos District

Thetford—The asbestos district of Quebec continues active and there is a tendency to open up new properties and resuscitate operations in some of those which have been dormant since 1908-9. The Boston Asbestos Co.'s plant at East Broughton will soon be ready to resume production, working under lease to Asbestos Mines, Ltd., J. A. Jacobs president, formerly of the Jacobs Asbestos Co. The same interests were planning development of the Clark property in the vicinity of the Reed's mine, Thetford Mines, but it is understood that nothing will be done for the present.

The plant at the Harris mine, at Coleraine, will be in operation in midsummer. The Bennett-Martin Asbestos & Chrome Co. is completing its plans for a branch line from the Quebec Central Ry. at Coleraine to its mine at Vimy Ridge, six miles distant.

The Reed Mining Co., near Thetford, which has been operated for the last year by Fillion & Blais, is being examined by the Weiser interests of Prescott, Ont., who may take it over.

Mr. Fitzgerald, president of the Sudbury Diamond Drilling Co., has arrived in Thetford with a force of men to do some work for the Asbestos Corporation of Canada, Ltd.

Chrome District

The new plant of the Mutual Chemical Co., at Caribou Lake has been operating since March 1 and giving excellent results. The deposits of chrome ore have been opened in good shape and another level of 100 ft. will be started immediately.

The J. V. Belanger Chrome Mining Co.'s new plant will be ready for operation next month.

The Dominion Mines & Quarries, Ltd., has come to the conclusion that the chrome industry of Canada does not offer the necessary inducements to continue work and has dismantled its plant at the Montreal Asbestos mine at Lake St. Francis and its Nadeau property at Thetford Mines.

NEW PUBLICATIONS

Official Year Book of the Commonwealth of Australia. 1918. By G. H. Knibbs. Board, 6 x 9, pp. 1,246. Published by the Commonwealth Bureau of Census and Statistics, Melbourne, Australia.

Official Year Book of the Union of South Africa. 1918. By C. W. Cousins. Board, 6 x 10, pp. 786. Published by the Union Office of Census and Statistics, Pretoria, South Africa.

These books are a record, more or less complete, of almost every subject about which a review can be written or statistical information can be tabulated. Many maps are included, the Australian volume containing a particularly good one of the commonwealth, size 30 x 40 inches. Mines and mining occupy fifty pages in this book, and, in the other, sixty pages are devoted to the mining industry of South Africa. These are excellent and authoritative reference books, valuable to anyone interested in the countries to which they relate. E. H. R.

Microscopic Examination of the Ore Minerals. By W. Myron Davy and C. Mason Farnham. Cloth, 6 x 9¼, pp. 154. McGraw-Hill Book Co., New York. Price $2.50.

In the preparation of the volume, the authors have based their consideration on work previously done by Campbell and Murdoch, in addition to a great deal of independent study. The excellent arrangement of the determinative tables, together with the supplementary tests, which may be applied to the study of ore minerals, makes this book one of great practical use to the profession as well as to the student of mining and geology. Microchemical reactions of about two hundred mineral species are listed, and the methods of procedure are recorded. D. E. A. C.

Latin-American Year Book for Merchants and Investors for 1919. Pp. 564; 2 maps. Criterion Newspaper Syndicate (Inc.), New York, 1919.

The book contains considerable descriptive material concerning each of the twenty-one Latin-American republics. The mineral resources of Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Haiti, Honduras, Mexico, Nicaragua, Peru, Salvador, Uruguay, and Venezuela are described briefly. The best portions are those dealing with the Oruro (Bolivia) tin mines, the Chilean nitrate situation, the present condition of the Brazilian manganese industry, the statistics of gold and silver production of Mexico, and the Mexican petroleum industry.

It is unfortunate that for a number of countries the mineral resources described or mentioned were poorly selected, in that they are not the most important. Considerable matter is given that is unreliable and now out of date, and many geographic names are misspelled. The mineral resources descriptions should be revised in later editions. B. L. M.

The Mining Manual and Mining Year Book for 1920—By Walter R. Skinner. 5½ x 8½, pp. 832; cloth. Published by Walter R. Skinner, 11-12 Clements Lane, London, E. C. 4. Price 21s. 6d., foreign postage paid.

The new edition of Skinner is out. The value of the book is indicated by the fact that we have a very hard time keeping it in our bookcase; in fact, the former edition had been missing for the past month, so this new book is even more welcome than usual. Our readers are more familiar with Weed's handbook, which should be issued within the next week or two. Skinner's publication has more of an English flavor than the other, and presents a fairly complete list of the principal mining companies of the world, along with those of lesser importance under British control. Not a great deal of space is devoted to plant descriptions, but full details of interest to the financier are given. The customary statistical information and lists of mining-company officials and mining engineers are appended. E. H. R.

Electric Furnaces in the Iron and Steel Industry. By W. Rodenhauser, J. Schoenawa, and C. H. Van Baur; Third edition, 6 x 9; pp. 444. John Wiley & Sons, New York.

In the preface to this edition the prediction is made that the number of electric furnaces now in use in the steel industry will be doubled in the next ten years. Considering this, and the fact that steel produced by the electric furnace made its debut less than twenty years ago, and that at the present time the world's production of electrically made steel totals annually over half a million tons, the process may be regarded as a highly valuable adjunct to the steel industry.

The volume consists of two parts. Part I covers historical matter, fundamental principles, operative conditions, and a description of the various types. Of the latter probably the best known in this country is the Heroult furnace, which of all the arc furnaces resembles most nearly a tilting open-hearth furnace. Part II considers material for furnace construction and costs of operation, and concludes with a general treatise on the electro-metallurgy of iron and steel. The issue is well arranged and should serve as an excellent guide to the student and operator alike. D. E. A. C.

Northern Manitoba—R. C. Wallace, Commissioner of Northern Manitoba, has written an interesting booklet of forty-five pages, including maps, descriptive of the mineral belt tributary to The Pas. The geological features of the district, and its history and development, both in regard to metallic and non-metallic minerals, are discussed. The information is particularly timely, in view of the current interest in Flin Flon and other properties in that neighborhood. Copies of the pamphlet, which is entitled "Mining and Mineral Prospects in Northern Manitoba," may be had by addressing Publicity Commissioner, Parliament Buildings, Winnipeg, Man.

Gasoline—A paper dealing directly with the recovery of gasoline, by means of the absorption process, from the residual gas in plants where motor fuel is obtained from natural gas by mechanical compression and cooling, has just been issued by the Bureau of Mines, as Technical Paper 232. In the absorption process, the gasoline present in the natural gas is absorbed by oil and subsequently separated from the oil by distillation, or is absorbed in naphtha and marketed without further treatment. The purpose of the paper is to point out more efficient methods of production of gasoline and motor fuel. Recommendations regarding the installation of equipment are made which will prove of value to all interested. Copies may be obtained free of charge by addressing the Director of the Bureau of Mines, Washington, D. C.

Minerals of Utah—An interesting bulletin on the mineral wealth and production of Utah has been prepared, known as Bulletin 12, Utah Engineering Station of the Bureau of Mines. The state has been for a number of years the second largest producer of silver in the United States. It has, in the Utah Copper Co.'s property, the largest copper mine in the world, and immense deposits of iron, coal, and hydrocarbons are available. Potential wealth lies in the deposits of oil shale, for the development of which a successful process will undoubtedly be found. The coke and cement industry has been established. Large deposits of ozocerite occur. Uranium and vanadium ores are produced near Green River, in the southern part of the state. Potash is being produced from alunite and from salt brines, and a large tonnage of phosphate rock can be mined for fertilizing purposes. The book contains a large amount of historical data, tables of the production of the various minerals, and a map showing the mining districts of the state. It may be had free of charge from the Director of the School of Mines of the University of Utah, Salt Lake City.

MEN YOU SHOULD KNOW ABOUT

Peter S. Haury has returned to San Francisco from Nevada.

Marcus Daly announces that he has moved his offices to Rooms 1511-1512, 8 West 40th St., New York City.

C. Wythe Cooke, geologist in the service of the Tropical Oil Co., reports his arrival at Barranca, Berneja, Colombia.

A. C. Leland has been appointed assistant superintendent of the Moctezuma Copper Co. properties at Nacozari, Sonora, Mexico.

K. F. Mather, an oil geologist, has returned from Bolivia, where he has spent the last six months examining prospective oil territory.

P. S. Smith and **O. C. Wheeler**, of the U. S. Geological Survey, spent last week visiting the potash lakes in the vicinity of Amarillo, Tex.

C. H. Cook has resigned from the Canadian Geological Survey, Ottawa, to accept a position as geologist for the Associated Gold Fields of Larder Lake.

A. E. Eldridge has been added to the staff of the United Verde Copper Co. at Jerome, Ariz., especially for service with the alien employees of the corporation.

J. D. Ireland and **C. N. Hickok**, of Cleveland, Ohio, and **E. E. Hunner**, of Duluth, have completed an inspection of the northern mines of the M. A. Hanna Co.

J. C. Greenway, general manager of the Calumet & Arizona Mining Co., Warren, Ariz., has been boomed in a number of Arizona papers as a candidate for U. S. Senator.

C. A. Bonine, of the Pennsylvania State College School of Mines, has joined the Land Classification Board of the U. S. Geological Survey and has been assigned to oil land work in Wyoming.

C. W. Whitley, 120 Broadway, New York City, a director of the American Smelting & Refining Co., is making an inspection of the company's properties in the Southwest. **B. A. La Barge** is accompanying Mr. Whitley.

H. C. Rizer, chief clerk of the U. S. Geological Survey, will represent that organization at the dedication exercises at Grand Canyon. Before returning to Washington he will visit the western offices of the Survey.

Thomas M. Schumacher, **William Church Osborne**, and **Frank Moffett** have returned to New York with **Cleveland H. Dodge** and others from a recent tour of inspection of the Phelps Dodge Corporation properties in New Mexico and Arizona.

Stuart A. Thorne, formerly manager of the Trethewey mine of Cobalt, Ont., who enlisted early in the war for service overseas, has been reappointed to his former position in succession to I. S. McReavy, who has been manager for the last two years.

F. H. Holladay, general manager for Winston-Dear, stripping contractors, with headquarters in Hibbing, Minn., has been elected vice-president of the company. He will continue in his active capacity as general manager of the stripping operations.

Charles E. Mills, who resigned as general manager of the Inspiration Consolidated Copper Co.'s mines and works at Miami, Ariz., to take on war work, has returned to Arizona, where he has large banking interests in association with Dr. L. D. Ricketts.

Felix E. Wormser, assistant metal-mining engineer, U. S. Bureau of Mines, resigned that post on March 15 to

FELIX E. WORMSER

accept a position on the staff of *Engineering and Mining Journal*. Mr. Wormser, who is a native of Santa Barbara, Cal., graduated from Columbia University School of Mines and worked as mining engineer with Snake River mines, the Baker Mines, and the Cornucopia Mines companies of Oregon from 1916 to 1918. In 1917 he was appointed U. S. Mineral Surveyor for Oregon, and from July to December, 1918, served in O. R. C., Engineering Section, U. S. A., receiving honorable discharge as a second lieutenant. Mr. Wormser was appointed to the U. S. Bureau of Mines in March, 1919, and there was chiefly occupied in collecting information on gold, silver, iron, copper, and other metals, for the monthly reports of investigations by the Bureau. He returned from Santa Barbara and joined the staff of the *Journal* on April 27.

William Morris Davis, engineer, geologist, and geographer, was awarded the Vega Medal on April 25. This medal is the highest distinction conferred by the Swedish Anthropological and Geographical Society of Stockholm.

F. W. Guernsey has been appointed general manager of the Mason Valley Mines Co., Thompson, Lyon County, Nev. He succeeds **A. J. McNab**, who has been in charge for some years. Mr. Guernsey was formerly in charge of the company's smelter at Thompson.

Hohman I. Pearl and associates of Crosby, Minn., known as the Associated Engineers, have started an assay office at The Pas, Manitoba, under the name of Allied Engineers, Ltd. **D. W. Warnock**, who was formerly in charge of the O'Connell laboratory at Crosby, has been placed in charge of the new office at The Pas.

L. D. Davenport, for the last four years chief engineer in the Hibbing district for the Oliver Iron Mining Co., has resigned and will become associated with E. M. Thayer & Co., of Boston, about May 1. Mr. Davenport is one of the pioneer engineers of the Mesabi Range, and in addition to having published several original articles on Mesabi mining practice has lately been editor-in-chief of the handbook of mining methods being prepared by the Engineers' Club of Northern Minnesota. On April 24 a farewell banquet was tendered him by the club. He is succeeded as chief engineer in the Hibbing district by **A. S. Diehl**, who has held a similar position in the Canisteo district, where he is succeeded by **R. P. Weidenfeller**, formerly assistant chief engineer in the district.

OBITUARY

Daniel Sisson, manager of the New York office of Phoenix Iron Works for thirty-four years, died of heart failure in Asbury Park, N. J., on April 16. Mr. Sisson, who was sixty-four years old and a native of Seneca Falls, N. Y., was a graduate in law from New York University, but early became interested in the silver mines of Colorado, where he spent some years. He had been with the Phoenix works almost from their beginning.

John Christy, late of Clifton, Ariz., and owner of several mines in that vicinity, died recently at Gila Bend, Ariz., where he was interested in a large agricultural development enterprise. Mr. Christy saw service in the Gordon relief expedition in Egypt, and then joined the Canadian Mounted Northwest Police. After amassing a fortune in the Alaskan gold fields and lumbering in Washington, he moved to Arizona.

R. L. Hogue mining engineer, representing Whicher & Co. and Weir Brothers, New York City, died at Reno, Nev., on April 26 from the injuries he received when his automobile went over an embankment while he was on his way to the Stimler mine on April 25. Mrs. Hogue and A. G. Cummings, who were in the car with Mr. Hogue, escaped uninjured.

THE MARKET REPORT

Published in part in San Francisco and mailed from there to our Western subscribers as a special service pending the arrival of the *Engineering and Mining Journal*

Silver and Sterling Exchange

April	Sterling Exchange	Silver		April	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
22	388	116¾	68⅝	26	384½	118	69⅝
23	388	118	69½	27	376	112	65
24	387½	118	69⅝	28	382	114½	66⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Daily Prices of Metals in New York

April	Copper	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
22	18.30	60½	61½@62	8.60	8.30	7.80@7.90
23	18.45	60¼	61 @61½	8.60	8.30	7.85@7.95
24	18.50	60¼	61 @61½	8.60	8.25	7.90@8.00
26	18.50	59¾	60¾@61¼	9.00	8.70	7.85@7.95
27	18.75	59½	60¾@61	8.90	8.60	7.85@7.95
28	18.75	59¾@60	61 @61½	8.90	8.60	7.80@7.90

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for prompt and nearby deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point. All prices are in cents per pound.

Copper is commonly sold on terms "delivered," which means that the seller pays the freight from refinery to buyer's destination. The delivery cost varies, and it would be confusing to figure net prices on individual transactions. Consequently, an average deduction is made from the "delivered" price. At present the average cost of delivery from New York refineries is 0.15c. per lb., and that deduction is made to arrive at the New York price. When copper is sold f.o.b. or f.a.s. New York, of course no deduction is made.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

April	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
22	100½	103¼	110	346	343½	39¾	41½	45½	47¼
23	101½	104¼	110	346½	343¾	40¼	41¾	46½	48⅛
24	....	....	...	....	....	...	...	...	...
26	103¼	105¾	111	346¾	345	40½	41½	49	50¼
27	105	107½	112	347¾	347	41½	42¾	49¼	51
28	103	105¾	112	347¼	346¼	41½	42½	47¾	49½

The above table gives the closing quotations on the London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb.

Metal Markets

New York, April 28, 1920.

Transportation difficulties continue to act as a brake on the metal market. Little metal can be moved in any direction, and the situation is much worse than is indicated in the newspapers. Consumers are not interested when delivery is so problematical, and are keeping out of the market. Copper continues quiet, with a firmer undertone. Lead and tin are erratic, and zinc continues weak.

Copper

Again this last week practically no copper has been sold by the big producers. Most of the small lots which could be delivered have been picked up, and during the last three days a firmer tendency has existed. The credit plans of the Copper Export Association will no doubt be officially announced in a few days, and will probably provide for three months' credit, subject to renewal, on European sales. France is likely to be one of the principal countries to profit by the scheme. The Japanese demand has been killed by financial conditions in Japan.

Domestic consumers, feeling that copper will soon be sold for export under the proposed credit arrangements, have been pricking up their ears a little, taking care to see that a sudden export demand, with a possible attendant increase in price, does not find them asleep.

Just how much copper remains unsold in refiners' hands is uncertain. Figures all the way from 200,000,000 to 550,000,000 lb. have been suggested. We are inclined to think the higher figure is nearer the truth. The "invisible stocks" in the hands of consumers, however, are much less than normal. With the existing labor troubles, and the approach of the summer season, production is likely to drop, and it may be that by September existing stocks will be pretty well absorbed. At any rate, the big producers are not worrying about these stocks the way they did a year ago; rather they are glad they have them.

Lead

Heavy pressure was brought to bear on the market during the last three days of last week, and a considerable amount was sold in the neighborhood of 8¼c., St. Louis. On Monday, however, the market seemed to recover its position of the early part of last week, and a fairly large tonnage of desilverized lead was sold at a price which netted close to 8⅜c., St. Louis. In the past two days practically no business has been done. Prompt lead commands a premium, and in cases where delivery can be made, almost any price within reason can be obtained for small lots. Futures are still selling under 8½c., St. Louis. Today's price of £41½ in London means that Mexican lead will go to Europe.

Zinc

The market remains very quiet. Electrolytic still brings about 9½c., New York, and the European demand is very good, particularly for France. The London market took a spurt on Monday, but is down again today. The strike of the laborers in the Connecticut brass mills and the freight embargo are interfering with domestic business.

Tin

Tin has been dead all the week, and has wobbled between 61 and 62c. The speculative movement in London seems to have quieted down. Futures may be had slightly under spot, but little interest exists in this metal for any delivery.

We quote electrolytic at 61½c. throughout the week, April 22 to April 28, inclusive. But little has been sold.

Straits tin for future delivery: April 22, 60½@61c.; April 23, 60½@61c.; April 24, 60¼@60¾c.; April 26, 60@60½c.; April 27, 60@60½c.; April 28, 60½@61c.

Arrivals of tin, in long tons: April 19, 51 instead of 80, as previously reported; April 21, Straits, 350; April 22, Buenos Aires, 28; April 23, Straits, 1,025; China, 165; April 24, Liverpool, 25; April 26, Straits, 100.

Gold and Silver

Gold was quoted in London on April 22 at 106s.; April 23, 106s. 9d.; April 26, 107s. 6d.; April 27, 109s.; April 28, 108s. 4d.

Foreign Exchange — Sterling has slumped badly, and yesterday sold as

low as $3.74⅜, but recovered somewhat today. Several reasons may be advanced, possibly the principal one being the selling of sterling by Japanese interests who have decided to transfer their accounts from London to New York, probably in order to be able to get gold for export should the need arise. Also, a large number of trade bills held in the hope of a further rise in sterling have been liquidated, and a lull has occurred in the gold shipments from London. Such violent fluctuations as occurred yesterday, for instance, also indicate speculation on a large scale, and doubtless this also has cut some figure in the decline. Other European money has also shown further depreciation, indicating that economic conditions are none too favorable. Francs and lire declined further, and yesterday were quoted, in units to the dollar, at 16.98 and 22.97 respectively. German marks gained about 10 points on the week and were worth 1.68 on Tuesday. Canadian dollars were to be had in New York yesterday at 8 per cent discount.

Silver—The market has shown little fluctuation for the last week, until the 27th, when under the pressure of China selling and Continental offerings, the London price dropped to 65d., and New York to $1.12. The market is steady at the decline. An improvement in China exchanges is expected, as the export season has begun.

Mexican dollars at New York: April 22, 88¼; April 23, 89⅜; April 24, 89⅜; April 26, 89⅜; April 27, 85; April 28, 86⅜.

Other Metals

Aluminum—Ingot is quoted at 33c., for 98@99 per cent virgin; good demand, strong market and metal hard to get. No. 12, 31½c.; sheets, 18 gage and heavier, 44.2c.; powdered, 60@65c.

Antimony—Some forced selling, and Japanese troubles have tended to depress the market, but conditions are fundamentally sound. Spot metal is quiet at 10@10½c. for ordinary brands; W. C. C., 10⅝c. and Cookson's "C" grade, 16c. Futures may be shaded slightly. Chinese and Japanese brands, spot, 10¼@10⅞c. Market easy, with few inquiries.

[1]**Needle Antimony** — The market for Chinese needle antimony in lump form is firm at 9½c. per lb., although demand continues quiet. Standard powdered needle antimony (200 mesh) is quoted at from 12@15c. per lb., according to quantity.

Bismuth—Unchanged at $2.70 per lb. for 500-lb. lots.

Cadmium—Price unchanged at $1.40 @$1.50 per lb.

[1]**Cerium Metal** — There has been no change from the price of $8@$9 per lb. in ingot form.

Cobalt—Prices remain unchanged at $2.50@$3 per lb. Black oxide sells at $2 per lb.

Iridium—Quoted nominally at $300; unchanged; metal extremely scarce.

Magnesium—Metallic, 99 per cent or over pure, $1.60@$1.85 per lb. Unchanged.

[1]**Molybdenum Metal** in rod or wire form, 99.9 per cent pure, is still selling at $32@$40 per lb., according to gage.

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c. No change.

Osmium—Quoted $150@$165 per troy oz. Unchanged.

Palladium Metal—Quiet at $105@ $115 per oz. 99 per cent pure.

Platinum—Plenty of metal available, but few buyers. Quoted at $115@$125 per oz.

Quicksilver—Market quiet and steady at $100 per 75-lb. flask. San Francisco telegraphs $93@$97; firm.

Ruthenium—Market value, $200@ $220 per troy oz. Unchanged.

[1]**Selenium**, black, powdered, amorphous, 99.5 per cent pure, continues to be quoted at $1.75@$2 per lb., depending on quantity.

[1]**Thallium Metal**—Selling at $18@$20 per lb., ingot, 99 per cent pure, depending on quantity.

Metallic Ores

Chrome Ore—Firm at an average of 75c. per unit. Small quantities of Turkish and Indian ore offered.

Iron Ores—Lake Superior ores, per ton delivered at Lower Lake ports, remain at prices fixed last year, as follows: Old Range bessemer 55 per cent iron, $7.45; Old Range non-bessemer, 55½ per cent iron, $6.70; Mesabi bessemer, 55 per cent iron, $7.20; Mesabi non-bessemer, 51½ per cent iron, $6.55. Lower Lake boats delayed by shortage of coal shipments.

Manganese Ore—Quotations are as follows: Brazilian, 45 to 50 per cent, c.i.f. Atlantic ports, 65@75c. per unit, nominal. Indian, 45 to 50 per cent, c.i.f. Atlantic ports, 65@80c. per unit. Caucasian, 48 to 50 per cent, f.o.b. cars, Atlantic ports, 60@65c. per unit, nominal. Chemical ore (MnO_2) quoted at $80@$90 per gross ton.

Molybdenite—Little change. Quoted at 75@85c. per lb. of contained sulphide for 85 per cent MoS_2, but may be obtained on long-time contracts at 50@60c.

[1]**Tantalum Ore**, guaranteed minimum 60 per cent tantalic acid, is still selling at 65@70c. per lb. in ton lots.

Titanium Ores—Ilmenite, 2c. per lb. of 52 per cent TiO_2. Unchanged. Rutile, standard imported Norwegian grade, carrying a minimum of 95 per cent titanium dioxide, in the form of concentrates, is quoted at 11c. per lb.

Tungsten Ore—Inclined to be firmer. Some Chinese wolframite has been sold for $6.80 per unit, but $7 is being asked. Bolivian is not being sold. Some low-grade scheelite has been sold at a low price. High-grade material is offered at $12 per unit, but only about $8.50 is bid.

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Uranium Ore (Carnotite)—$2.75@$3 per lb. for 96 per cent of the contained oxide (U_3O_8). Ores must contain a minimum of 2 per cent U_3O_8.

Vanadium Ore—$6 per lb for 99 per cent of the vanadic oxide (V_2O_5) contained.

Zircon—Washed, iron free, continues to be quoted at 10c. per lb. Zirkite—In carload lots, $90@$100 per ton is quoted. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., April 24—Zinc blende, per ton, high, $51.35; basis 60 per cent zinc, premium, $46; Prime Western, $45; fines and slimes, $42.50@ $40; calamine, 40 per cent zinc, $35. Average settling prices: Blende, $50.74; calamine, $36.84; all zinc ores, $50.67.

Lead, high, $111.30; basis 80 per cent lead, $110; average settling price, all grades of lead, $108.98 per ton.

Shipments the week: Blende, 12,325, calamine, 57, lead, 2,209 tons. Value, all ores the week, $868,240.

Shipment four months: Blende, 214,519; calamine, 3,143; lead, 31,450 tons. Value, all ores four months, $14,515,680.

Settling prices this week continue to remain conspicuously above the basis prices, owing to settlements being made on purchases of several weeks ago. Buying this week dropped to 9,100 tons, approximately 2,500 tons less than the output. Shippers are closing up on the large advance purchases at all mines where the ore is produced. There are 10,000 to 15,000 tons, however, still sold ahead of production, and about 20,000 tons of unsold ore in the bins.

Platteville, Wis., April 24—Blende, basis 60 per cent zinc, $52 base for high grade. Lead ore, basis 80 per cent lead, $105 per ton. Shipments for the week: Blende, 1,683; calamine, 90; lead, 30; sulphur ore, 76 tons. Shipments for the year to date: Blende, 25,505; calamine, 1,290; lead, 2,069; sulphur ore, 285 tons. During the week 2,276 tons blende was shipped to separating plants.

Non-Metallic Minerals

Asbestos—Quoted per short ton f.o.b. Thetford, Broughton and Black Lake mines, Quebec, Canada. Freight rate from mines to Sherbrooke, Quebec, over Quebec Central R.R., 20c. per cwt; from Sherbrooke to New York, 27½c., carload lots. Crude No. 1, $1,750@ $2,000; crude No. 2, $1,200@$1,500; spinning fibres, $500@$750; magnesia and compressed sheet fibres, $275@ $400; single stock, $95@$150; paper stock, $60@$75; cement stock, $27.50@ $32.50; floats, $15@$17.50 per short ton. Unchanged.

Barytes—Pressure of heavy demand and difficulty in transportation still continue to affect general situation. White floated is listed at $35@$40 and off-color at $25@$30 per ton.

Blanc Fixe (Barium Sulphate)—Dry, 4½@5½c. per lb.; pulp, $30@$50 per ton f.o.b. New York.

Chalk—English, extra light, 5@7c. per lb.; light, 4½@6c. per lb.; dense, 4@5c. per lb. f.o.b. New York. Unchanged.

China Clay (Kaolin)—Imported lump, $25@$35 per ton; imported powdered, $30@$60 per ton; domestic lump, $10@$20 per ton; domestic powdered, $25@$40 per ton f.o.b. New York.

Feldspar — Situation remains unchanged with $13.50@$18, ground grade, f.o.b. New York State still holding firm.

Fluorspar—Gravel, 85 per cent, f.o.b. Kentucky and Illinois mines, is quoted at $25 net ton. Ohio district, prompt, per ton, $28.

Fuller's Earth—Remains firm at $25@$30 per ton for domestic and $35@$40 for foreign, with little material available at these prices.

Graphite — Present quotations for crucible flake are: 85 per cent carbon content, 7½c. per lb.; 86 per cent, 8c.; 87 per cent, 8½c.; 88 per cent, 9½c.; 89 per cent, 9½c.; 90 per cent, 10½c.; 91 per cent, 10½c.; 92 per cent, 11c.; over 92 per cent, 12½c. per lb. delivered. Mexican amorphous graphite is being sold at $55@$60 per short ton; Korean, 3¾c. per lb.; Madagascar, 9c.; Ceylon, 4⅞@16c., according to quality. Unchanged.

Gypsum—Wholesale price, plaster of paris in carload lots, is $3.25 per 250-lb. bbl. Sufficient demand, but scarcity of material.

Magnesite—Dead burned, for refractory (see Refractories).

Calcined Magnesite — High-grade caustic calcined, in lump form, is selling at $35@$40 per ton in carload lots f.o.b. California points. The price of freshly ground calcined, suitable for the flooring trade, is $65@$75 per ton f.o.b. Eastern points.

Monazite—Product carrying a minimum of 6 per cent thorium oxide, $42 per unit is quoted, duty paid.

Nitrate—Supplies are scarce, but quotations remain at $3.90 per cwt., ex vessel, Atlantic ports. Futures, $3.90@$4.50, but very quiet.

Phosphate Rock—Prices quoted per long ton at port are: 68 per cent tricalcium phosphate, $6.85; 70 per cent, $7.35; 74 to 75 per cent, $10; 75 per cent minimum, $10.50; 77 per cent minimum, $12.50. Unchanged.

Pumice Stone—Imported, 3@6c. per lb.; domestic, 2½c. per lb. Unchanged.

Pyrites—Improvement in situation slight, although buying is still "hand to mouth." Domestic pyrites, fine, is selling at 16½c. per unit.

Sulphur—No change. There is still a fair demand, with prices averaging $18 per ton for domestic, and $20 for export, f.o.b. Texas and Louisiana mines.

Talc—Domestic, $20@$30 per ton; imported, $60@$70 per ton f.o.b. New York.

Ferro Alloys

Ferrocarbontitanium—For 15-18 per cent material, $200@$250 per ton f.o.b. Niagara Falls, N. Y. Unchanged.

[1]Ferrocerium—Conditions abroad continue to cause a reduction in price of the American goods, and this alloy is now selling at $12@$15 per lb.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 4 to 6 per cent carbon, 18@19c. per lb. of chromium contained.

Ferromanganese—Domestic, 76 to 80 per cent, delivered, $200 per ton for futures; early deliveries, $245@$250; small lots, spot, $250 per ton. English, c.i.f., tidewater, $200.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, are quoted at $2.25@$2.75 per lb. of contained metal.

Ferrosilicon—$85@$90, 50 per cent, delivered, spot and contract. Electrolytic, delivered Pittsburgh Valleys, Cleveland: 50 per cent, $81; 75 per cent, $140. Bessemer, f.o.b. Jackson, Ohio, 10 per cent, $62.50; 11 per cent $65.80; 12 per cent, $69.10.

Ferrotungsten — 70-80 per cent W, 85c@$1.15 per lb. contained tungsten.

Ferro-uranium—35-50 per cent U, $7 per lb. of U contained. Unchanged.

Ferrovanadium—30-40 per cent, $6.50@$7 per lb. of V contained.

Spiegeleisen—Increased demand at $75 for 19 to 21 per cent. Large inquiries have developed from Germany and South America.

Metal Products

Copper Sheets—No change since Jan. 7 price of 29½c. per lb.; wire, quoted 22½@22⅝c.; strong.

Lead Sheets—Full lead sheets, 12½c.; cut lead sheets, 12½c. in quantity prices, mill lots. Unchanged.

Nickel Silver—Unchanged at 39½c. per lb. for 18 per cent nickel.

Yellow Metal — Dimension sheets, 26¾c.; sheathing, 25¾c.; rods, ⅝ to 3 in., 23¾c. Unchanged.

Zinc Sheets—$12.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 12c. per lb. Unchanged.

Refractories

Chrome Brick—Unchanged at $70@$75 per net ton, f.o.b. Chester, Pa.

Chrome Cements—Unchanged at $45@$50 per net ton, f.o.b. Chester, Pa.

Clay Brick—First-quality fire clay, $45@$50 per 1,000, f.o.b. Clearfield, Pa.; second quality, $40@$45 per 1,000, f.o.b. Clearfield, Pa.

Magnesite—Dead burned, $50@$55 per net ton, f.o.b. Chester, Pa.; brick, 9 x 4½ x 2½ in., $80@$85 per net ton, f.o.b. Chester, Pa. Unchanged.

Silica Brick—$50@$55 per 1,000, f.o.b. Mt. Union, Pa.

Iron Trade Review

Pittsburgh, April 26, 1920

So far, at least, as concerns production and shipment of steel from Pittsburgh and Valley mills, the daily newspaper reports of the waning of the rail strike are altogether misleading. Conditions in this general territory are almost as bad as when the strike was at its height. The Mahoning and Shenango Valleys are practically altogether tied up, there being only an occasional operation and no shipments to speak of. Cleveland is also in almost as bad condition as at any time. In the immediate Pittsburgh district production of pig iron and finished steel is not much below normal, but shipments are extremely light. Earlier in the strike most of the steel produced was loaded, the cars proceeding short distances or being kept on mill sidings, but the supplies of empties have almost run out. Experiences vary widely at different mills and in different districts. For instance, today the American Sheet & Tin Plate Co. is operating at only 15 per cent, but on Saturday it had the gratifying experience of shipping 148 carloads, or more than a normal day's production. This, however, left 70,000 tons in stock at the various mills of material made on order and awaiting shipment. There is no definite information, nor even any speculation, as to when and how the rail strike will end. The one definite conclusion accepted is that after the strike itself is over shipping conditions will be very poor for several weeks.

Pig Iron—Second-quarter basic iron has sold in two or three large lots at $43, Valley, against $41.50, formerly quoted as the general market; bessemer has gone at $42.50, Valley, for early deliveries, against $42 formerly ruling for early and late deliveries. There is practically no call for second-half iron, and the market becomes quotably higher when the volume of demand decreases. We quote: Bessemer, $42.50; basic, $43; foundry, $43, f.o.b., Valley furnaces, freight to Pittsburgh being $1.40.

Steel—Two or three producers of sheet bars have quoted $70 on bessemer and $75 on openhearth bars for third quarter, and one or two other mills refuse to quote as yet for third quarter, even to regular customers. Recent sales of early deliveries were at $75 and $80, making a quotable market of $70 to $80. Billets are practically nominal at about $60.

Charcoal and Coke

Charcoal—Large quantities sell as follows: Willow, 7c per lb.; hardwood, 4½c. per lb., in 250-lb. bbl.

Connellsville—Prompt furnace, $11@$12; prompt foundry, $12@$13; contract foundry, $10@$12 per net ton at ovens.

New River—Furnace, $10@$11, and foundry, $11@$12 per ton.

Pocahontas—Furnace, $10@$12 per ton.

Wise County — Furnace, $10@$12 per ton; foundry, $11@$12 per ton.

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

COMPANY REPORTS

Nevada Consolidated Copper Co.

Copper; Nevada

The thirteenth annual report of the Nevada Consolidated Copper Co. states that during the year 43,971,892 lb. of copper was produced, as compared with 76,607,062 lb. in 1918. Total ore (including custom ore) concentrated during the year was 2,215,481 tons. Operating cost of producing refined copper, including depreciation and other expenses, was 18.65c. per lb. Receipts for 1919 were $8,535,728.55; operating expenses, $8,199,703.95, and dividends amounted to $2,999,185.50. The balance on Dec. 31, 1919, was $8,160,533.02, as compared with $9,934,361.25 the year previous. During the year mines, concentrator, and smelter operated at about 50 per cent of production. During the month of August a strike of employees caused a suspension of all mining, milling, and smelting operations.

Ahmeek Mining Co.

Copper; Michigan

The Ahmeek Mining Co., for the year ended Dec. 31, 1919, produced 17,223,111 lb. of copper, at a cost of 14.02c. per lb., and 12,167,613 lb. was sold, at 18.81c. per lb. Dividends amounted to $600,000. The balance of current assets on Dec. 31, 1919, amounted to $2,709,065.20, as compared with $2,438,720.25 the year previous. During the year, 756,870 tons of rock was treated, at a cost, covering mining, transportation, stamping, and taxes, of $2.59 per ton. Underground work consisted of 364 ft. of shaft sinking and 17,771 ft. of openings. Dividends paid to Dec. 31, 1919, total $11,850,000.

La Salle Copper Co.

Copper; Michigan

The La Salle Copper Co. reports for the year ended Dec. 31, 1919, as follows: Copper produced, 340,719 lb.; production cost, $139,231.88; sold during the year, 631,476 lb. of copper; tons of rock treated, 32,995, and cost of mining, transportation, stamping and taxes, $2.55 per ton of rock. Balance of current assets on Dec. 31, 1919, was $366,045.41. Underground work consisted of 126 ft. of shaft sinking and 1,419 ft. of drifting at No. 2 shaft. During January and February stoping was done on the 10th, 12th, and 15th levels of No. 1 shaft. No dividends were paid.

Winona Copper Co.

Copper; Michigan

The Winona Copper Co. reports a profit-and-loss balance on Jan. 1, 1920, of $1,414,752.40, as compared with $1,301,362.07 on Jan. 1, 1919. Expenditures during 1919 totaled $202,375.47, and revenue, including 388,812 lb. of copper valued at 18¼c. per lb. and deducting inventory (Jan. 1, 1919) of $71,232.32, totaled $88,985.14. During the year 39,654 tons of rock was stamped and yielded 561,238 lb. refined copper.

Chile Copper Co.

The twelfth quarterly statement of the Chile Copper Co., covering the fourth quarter of 1919, reports that 22,916,740 lb. of copper was produced. During the quarter 955,996 tons of ore was treated, averaging 1.61 per cent copper; and 16,466,812 lb. of copper was sold. A loss of $300,211.27 was sustained on copper delivered, although miscellaneous income and interest bring the balance up to $229,200.36. Deducting amortized discount, accrued bond interest, and expenses (credit, $701.26) balance of undivided profits shows a loss of $590,916.38.

Isle Royale Copper Co.

Copper; Michigan

The Isle Royale Copper Co. reports for the year ended Dec. 31, 1919, that 13,007,647 lb. of copper was produced, at a cost of 15.80c. per lb., and 8,834,380 lb. was sold, at 18.60c. per lb. Dividends paid amounted to $150,000. Balance of current assets on Dec. 31, 1919, amounted to $1,863,270.18, as compared with $1,601,606.47 the year previous. During the year 724,667 tons of rock was treated, at a cost, covering mining, transportation, stamping, and taxes, of $2.35 per ton. Underground work consisted of 590.5 ft. of shaft sinking and 9,884 ft. of drifting, drift stoping and crosscutting.

Yukon Gold Co.

The Yukon Gold Co., for the year ended Dec. 31, 1919, reports that production totaled $1,699,632.53, this sum representing the work of the Dawson dredges, Dawson hydraulic operations, California dredges, the Murray dredge, and miscellaneous operations. Working costs were $1,190,742.30. After deducting for royalties and interest charges, net operating income was $335,330.25. Further deductions for depletion, depreciation, and stock investments written off amounted to $1,444,014.62, leaving a net deficit for 1919 of $1,108,684.37. Dredges handled a total of 8,530,651 cu.yd., and yardage mined by hydraulic operations amounted to 2,220,656 cu.yd.

Rio Tinto Co., Ltd.

Copper; Spain

According to the forty-seventh annual report of the Rio Tinto Co., Ltd., profits on sales during 1919 totaled £941,821 12s. 1d. This sum, together with interest on investments, transfer and other fees, and the balance from 1918, totals £1,538,251 18s. 2d. After deducting taxes, administration expenses, welfare expense, interest, and allowances, a balance of £1,179,920 8s. 9d. remained. Total distribution of dividends was £831,250, leaving a balance carried forward of £348,670 8s. 9d.

Nipissing Mines Co., Ltd.

Silver; Ontario

The fifteenth annual report of the Nipissing Mines Co., Ltd., states that 2,906,787.40 oz. of silver was produced during 1919, having a net value of $3,734,860.22. Shipments for the year totaled 3,080,069.93 oz., of a net value of $3,553,958.84. Total cost of production was $1,034,772.04, or $15.63 per ton, and net profit on operations amounted to $2,717,311.56, which is the largest in the history of the company. Dividends totaled $1,845,000, including one dividend of $600,000 paid in January, 1920. The company received an average of $1.2077 per oz. for silver produced during the year.

Chino Copper Co.

Copper; New Mexico

The tenth annual report of the Chino Copper Co. shows that the net copper production for the year ended Dec. 31, 1919, was 40,488,706 lb., which was produced at a cost of 15.53c. per lb. In addition, there was produced gold and silver valued at $17,927.90. Operating revenue for the year was $7,326,525.49, and expense was $6,287,616.93. Total net income amounted to $1,301,797.03, or at the rate of $1.50 per share, and balance on Dec. 31, 1919, after deduction of dividends, which amounted to $2,609,940, was $13,549,095.36. Total disbursements to stockholders up to and including Dec. 31, 1919, were $29,012,982.

MINING STOCKS

Week Ended April 24, 1920

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Adventure	Boston	1	¾	1	
Ahmeek	Boston	66	66	66	Mar. '20, $ .50
Alaska-B.C	N. Y. Curb	2 1/16	1⅞	1⅞	
Algomah	Boston	*30	*30	*30	
Allouez	Boston	32	32	32	Mar. '19, 1.00
Anaconda	N. Y.	62⅜	56¼	57¼	Feb. '20, 1.00
Ariz. Com'l	Boston	12¼	11¼	11¼	Oct. '18, .50
Big Ledge	N. Y. Curb	⅜	5/16	5/16	
Bingham Mines	Boston	9	8	8⅛	Sept. '19, .25
Calumet & Ariz	Boston	64	60⅞	61	Mar. '20, 1.00
Calumet & Hecla	Boston	350	340	340	Dec. '19, 5.00
Can. Copper	N. Y. Curb	1 1/16	1½	1 5/16	
Centennial	Boston			13	Dec. '18, 1.00
Cerro de Pasco	N. Y.	52½	46⅜	47	Mar. '20, 1.00
Chief Consol	Boston Curb	4½	4	†4	Feb. '20, .10
Chile Cop	N. Y.	18	16½	16½	
Chino	N. Y.	36¼	33	33¼	Mar. '20, .37½
Con. Ariz	N. Y. Curb			⅜	Dec. '18, .05
Con. Copper M	N. Y. Curb	4⅜	4¼	4¼	
Cop. Range	Boston	43⅛	41	41	Mar. '20, .50
Crystal Cop. (new)	Boston Curb	*28	*26	*27	
Davis-Daly	Boston	10⅜	9⅞	9⅞	Mar. '20, .25
East Butte	Boston	14	13	13	Dec. '19, .50
First Nat'l	Boston Curb	1⅞	1⅞	1 15/16	Feb. '19, .15
Franklin	Boston	3¼	3	3	
Gadsden Copper	N. Y. Curb			1	
Granby Consol	N. Y.	44	40	40	May '19, 1.25
Greene-Can	N. Y.	33	33	33	Feb. '19, 1.50
Hancock	Boston	4⅜	4⅜	4⅜	
Helvetia	Boston	2⅛	2⅛	2⅛	
Houghton	Boston Curb	*80	*55	*55	
Howe Sound	N. Y. Curb			4	Jan. '20, .05
Inspiration Con	N. Y.	57¼	51⅛	53	Apr. '20, 1.50
Iron Cap	Boston Curb	†12	11	†11	Feb. '19, .25
Isle Royale	Boston	31½	30⅜	30⅜	Sept. '19, .50
Jerome Verde	N. Y. Curb			1/16	
Kennecott	N. Y.	30⅜	27⅞	28⅜	Mar. '20, .50
Keweenaw	Boston	1⅝	1⅝	1⅝	
Lake Copper	Boston	4	4	4	
La Salle	Boston	3	3	3	
Magma Chief	N. Y. Curb			5/16	
Magma Copper	N. Y. Curb	39½	30½	36	Jan. '19, .50
Majestic	Boston Curb	*20	*17	†*17	
Mason Valley	N. Y. Curb	2¼	2¼	2¼	
Mass Con	Boston			5⅛	Nov. '17, 1.00
Mayflower-O. C.	Boston	8⅛	7⅛	7⅛	Feb. '20, 1.00
Miami	N. Y.	23⅛	21⅛	22⅛	Feb. '20, .50
Michigan	Boston	6⅛	6⅛	6⅛	
Mohawk	Boston	65⅞	63	63	Feb. '20, 1.50
Mother Lode (new)	N. Y. Curb	5⅛	5⅛	5⅛	
Nev. Con	N. Y.	14⅛	14	14	Mar. '20, .25
Nev. Douglas	Boston Curb	†*17	*16	†*16	
New Arcadian	Boston	3⅛	3	3	
New Baltic	Boston Curb			3	
New Cornelia	Boston	22	19⅞	19⅞	Nov. '18, .25
Nixon Nev	N. Y. Curb	18	8	9	
North Butte	Boston	21⅛	18⅜	19¼	Oct. '18, .25
North Lake	Boston			⅛	
Ohio Copper	N. Y. Curb			3/16	
Ojibway	Boston			2⅜	
Old Dominion	Boston	31	30	30	Dec. '18, 1.00
Oneco	Boston Curb	*70	*40	*40	
Osceola	Boston	45	44½	44½	Mar. '20, .50
Phelps Dodge	Open Market	230	220	...	Apr. '20, 2.50
Quincy	Boston	58	57	58	Mar. '20, 1.00
Ray Con	N. Y.	19⅛	17¾	18¼	Mar. '20, .25
Ray Hercules	Boston Curb			*75	
St. Mary's M. L.	Boston	46	45	45	Dec. '19, 2.00
Seneca	Boston	14⅛	13	13⅛	
Shannon	Boston	1⅛	1⅛	1⅛	Nov. '17, .25
Shattuck-Ariz	N. Y.	11	10	10⅜	Jan. '20, .25
South Lake	Boston	2⅜	2⅜	2⅜	
South Utah	Boston	*15	*15	*15	
Superior	Boston	5⅛	5	5	Apr. '17, 1.00
Superior & Boston	Boston	5	4½	4½	
Tenn. C. & C	N. Y.	11⅜	10⅛	10⅞	May '18, 1.00
Tuolumne	Boston	*75	*75	*75	
United Verde. Ex.	Boston Curb	*35½	*34	*34	Feb. '20, .50
Utah Con	Boston	8¼	7¼	7⅛	Sept. '18, .25
Utah Copper	N. Y.	76½	70	71½	Mar. '20, 1.50
Utah M. & T	Boston	2⅛	2	2⅛	Dec. '17, .30
Victoria	Boston			3	
Winona	Boston	*100	*99	*99	
Wolverine	Boston	18⅛	18	18	Jan. '20, .50
LEAD					
Hecla	N. Y. Curb	4 1/16	2⅛	4⅛	Mar. '20, .15
St. Joseph Lead	N. Y.	16¼	14¾	15¼	Mar. '20, .50
Stewart	Boston Curb	*18		*16	Dec. '15, .05
Utah Apex	Boston	2¼	2¼	2¼	Nov. '18, .25

*Cents per share. †Bid Apr. 24.

Stock	Exch.	High	Low	Last	Last Div.
ZINC					
Am. Z. L. & S	N. Y.	18	16½	17½	May '17, 1.00
Am. Z. L. & S. pf.	N. Y.	53	51½	51½	Feb. '20, 1.50
Butte C. & Z	N. Y.	10	9	9½	July, '18, .50
Butte & N. Y	N. Y. Curb			⅜	
Butte & Superior	N. Y.	25⅜	23⅛	24⅛	Sept. '17, 1.25
Con. Interst. Cal.	N. Y.	17⅛	15¼	15½	Mar. '20, .50
New Jersey Z	Open Market	294	292		Dec. '19, 2.00
Success	N. Y. Curb	*6	*5	*5	July '16, .03
GOLD					
Alaska Gold	N. Y.	1⅛	1⅛	1⅛	
Alaska Juneau	N. Y.	2⅛	2⅛	2⅛	
Carson Hill	N. Y. Curb	27½	26	26½	
Cresson Gold	N. Y. Curb			2⅛	Mar. '20, .10
Dome Ex	Toronto	*28	*25	†*25	
Dome Lake	Toronto	*8½	*6	†*7½	
Dome Mines	N. Y.	11	9⅜	9⅜	Apr. '20, .25
Goldfield Con	N. Y. Curb	*13	*10	*11	Dec. '19, .05
Hedley	Boston			4½	June '19, .10
Hollinger Con	Toronto	6.50	6.30	†6.30	Apr. '20, .05
Homestake	N. Y.	60	60	60	Sept. '19, .50
Kewanas	N. Y. Curb	*3	*2	*3	
Kerr Lake	Toronto	5.00			Sept. '19, 1.00
Kirkland Lake	Toronto	*60	*55	†*55	
Lake Shore	Toronto	1.15	1.03	†1.05	Oct. '19, .02½
McIntyre Porcupine	Toronto	2.10	2.05	2.05	Jan. '20, .05
North Star	Boston				June, '19, .40
Porcupine Crown	Toronto	*31½	*29	*30	July, '17. .03
Reorgan. Booth	N. Y. Curb	5	4½	5	
Silver Pick	N. Y. Curb	*12	*10	*11	
Teck-Hughes	Toronto	*17	*14	*14	
United Eastern	N. Y. Curb	3 13/16	3 5/16	3⅜	Apr. '20, .21
West Dome	Toronto	*9⅛	*8	*8⅛	
White Caps Min	N. Y. Curb	*15	*12	*12	
Yukon Gold	Boston Curb	†1¼	†1¼		June '18, .02½
SILVER					
Arizona Silver	Boston Curb	*100	*90	†*90	Apr. '20, .03
Bailey	Toronto	*6	*5½	*5½	Apr. '16, .05
Beaver Con	Toronto	*55	*48	*48	
Coniagas	Toronto	3.00	2.85	†2.90	Feb. '20, .12½
Crown Reserve	Toronto	*35	*30	*30	Jan. '17, .05
Kerr Lake	Boston	4⅛	4⅛	4⅛	Sept. '19, 1.00
La Rose	Toronto	*48	*42	*42	Apr. '18, .02
McKinley-Dar	N. Y. Curb	*58	*53	*55	Apr. '20, .03
Mining Corp	Toronto	2.00	1.90	1.90	Sept. '19, .12½
Nipissing	N. Y. Curb	10⅛	10	10	Apr. '20, .25
Ontario Silver	N. Y.	8⅜	7⅛	7⅛	Jan. '19, .50
Ophir Silver	N. Y. Curb	⅛	⅛	⅛	
Peterson Lake	Toronto	*19¼	*16	*16	Jan. '17, .01½
Sil. King Ariz. (new)	N. Y. Curb			*53	
Temiskaming	Toronto	*45¼	*43	*43	Jan. '20, .04
Trethewey	Toronto	*44	*37	*37	Jan. '19, .05
GOLD AND SILVER					
Atlanta	N. Y. Curb	*2⅛	*2	*2⅛	
Bost. & Mont	N. Y. Curb	*61	*58	*60	
Cashboy	N. Y. Curb	*8	*7	*7⅛	
El Salvador	N. Y. Curb	3	2⅜	2⅜	
Goldfield Merger	N. Y. Curb	*3	*2⅛	*2⅛	
Jim Butler	N. Y. Curb	*22	*19	*21	Aug. '18, .07
Jumbo Extension	N. Y. Curb	*8	*6	*6⅛	June '16, .05
Louisiana Con	N. Y. Curb	⅛	⅛	⅛	
MacNamara	N. Y. Curb			*⅛	
Nev. Packard	Boston Curb	*25			Apr. '19, .02
N. Y. Hond. Rosar	N. Y. Curb	15½	14		Apr. '20, .50
Rochester Mines	N. Y. Curb			*18	Oct. '18, .02
Tonopah-Belmont	N. Y. Curb	2⅛	1 13/16	2	Jan. '20, .05
Tonopah-Divide	N. Y. Curb	1⅜	1 5/16	1⅜	
Tonopah Ex	N. Y. Curb	2⅛	1 13/16	1⅞	Apr. '20, .05
Tonopah Mining	N. Y. Curb	1 11/16	1⅝	1⅝	Oct. '19, .15
West End Con	N. Y. Curb	1⅛	1 5/16	1⅜	Dec. '19, .05
SILVER-LEAD					
Caledonia	N. Y. Curb	*32	*30	*31	Apr. '20, .01
Consol. M. & S	Toronto	27⅜	27	27	Apr. '20, .62½
Daly-West	Boston	4½	4½	4½	Apr. '20, .15
Eagle & Blue Bell	Boston Curb	1⅛	1 1/16	†1 1/16	Apr. 20, .10
Fed. M. & S	N. Y.			15	Jan. '09, 1.50
Fed. M. & S. pf	N. Y.	38	35½	35½	Mar. '20, .75
Iron Blossom	N. Y. Curb	⅜	5/16	5/16	Jan. '20, .02½
Marsh Mines	N. Y. Curb	*20	*17	*18	
Prince Consol	N. Y. Curb	⅜	⅛	1 1/16	Nov. '17, .02½
Rex Con	N. Y. Curb	*8	*6½	*7	
Simon S. L	N. Y. Curb			*1⅛	
Stand. S. L	N. Y. Curb	5/16	3/16	3/16	Oct. '17, .05
Wilbert	N. Y. Curb	*6	*5	*6	Nov. '17, .10
NICKEL-COPPER					
Internat'l Nickel	N. Y.	22⅞	20	20⅜	Mar. '19, .50
Internat'l Nick. pf	N. Y.	84½	84½	84½	Feb. '20, 1.50
QUICKSILVER					
New Idria	Boston	7	7	7	Jan. '19, .25
TUNGSTEN					
Mojave Tungsten	Boston Curb	†*10	*7	†*7	
VANADIUM					
Vanadium Corpn	N. Y.	95½	73	78½	Apr. '20, 1.50
MINING, SMELTING AND REFINING					
Am. S. & R	N. Y.	68⅞	61½	61⅜	Mar. '20, 1.00
Am. S. & R., pf	N. Y.	95½	94½	94½	Mar. '20, 1.50
Am. Sm. pf., A	N. Y.	82⅜	80	80⅜	Apr. '20, 1.00
Natl. Lead	N. Y.	86½	79⅜	80⅜	Mar. '20, 1.00
Natl. Lead, pf	N. Y.	107½	107½	107½	Mar. '20, .75
U. S. Sm. R. & M.	N. Y.	68½	64¼	64¼	Apr. '20, 1.50
U. S. Sm. R. & M., pf	Boston	46½	45½	46	Apr. '20, ½